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Vol. 54 SEPTEMBER, 1942 No. 3

The Wilson Bulletin

Published by the

Wilson Ornithological Club

Ann Arbor, Michigan

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THE WILSON BULLETIN

is published quarterly in March, June, September, and December, as the official organ of the Wilson Ornithological Club, at Ann Arbor, Michigan, and is sent to all members not in arrears for dues. The subscription price is $2.00 a year, invariably in advance, in the United States. Single numbers, 50 cents. Outside of the United States the rate is $2.25. Single numbers, 60 cents. Subscriptions should be sent to the Treasurer.

All articles and communications for publications, books and publications for review, exchanges, and claims for lost or undelivered copies of the magazine, should be addressed to the Editor.

The current issue of *The Wilson Bulletin* is printed by the Ann Arbor Press, Ann Arbor, Michigan.

Entered as second class matter July 13, 1916, at Ann Arbor, Michigan, under Act of Congress of March 3, 1879.

THE WILSON ORNITHOLOGICAL CLUB

Founded December 3, 1888. Named after Alexander Wilson, the first American ornithologist, and called the "Father of American Ornithology."

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Cliff Swallow gathering mud. Muscongus, Maine, July 15, 1942. Photograph by Allan D. Cruickshank.

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THE WILSON BULLETIN
A QUARTERLY MAGAZINE OF ORNITHOLOGY
Published by the Wilson Ornithological Club

Vol. 54 SEPTEMBER, 1942 No. 3

A MANAGED CLIFF SWALLOW COLONY IN SOUTHERN WISCONSIN

BY IRVEN O. BUSS

SEVERAL writers have described techniques and methods for songbird management. Most of the management practices are general suggestions applicable to a number of species. I know of no one who has measured the results from managing a species of songbird over a long period of time.

Mr. Cory Bodeman of Deerfield, Wisconsin, has succeeded in increasing a single pair of Cliff Swallows (*Petrochelidon albifrons albifrons*) to a colony of over 4,000 birds in 38 years. Without his help it is doubtful whether or not the first pair of birds, which arrived in 1904, would ever have succeeded in raising any young. It is certain that the present colony would be much smaller if the swallows had not been assisted.

Early History

In early May, 1904, a pair of Cliff Swallows started building their nest on the east side of Mr. Bodeman's unpainted barn. The mud structure was located under a 20-inch eave and fastened to one of the two-inch vertical strips or battens that covered the cracks of the upright "siding." Daily observations showed that the swallows succeeded in hatching their eggs, but English Sparrows (*Passer domesticus*) killed the young at an early age and dragged them from their nest. The parent birds remained about the barn until late July, but did not lay a second clutch of eggs.

As a boy of 16, Mr. Bodeman became very angy with the sparrows and declared war on them immediately. Shot was expensive and not easy to get in 1904, so selected gravel was substituted in his father's muzzle-loading shotgun. It is impossible to estimate the number of sparrows shot during the years of the muzzle-loader, but the weathered boards around the barn are densely pock-marked, attesting to thousands of rounds fired.

The second year (1905) a pair of swallows nested in the same nest built the previous year. It is likely that these were the same birds that first constructed the nest, for they arrived on almost the same date, and occupied the nest immediately upon arrival. Both the resident and

neighboring sparrow populations were now greatly reduced; hence, the swallows had no difficulties in successfully hatching and rearing their young.

The swallows gradually increased until 1911, but that year there appeared to be fewer birds than in any of the preceding three years. Mr. Bodeman believes that drought conditions during 1910 caused a number of the swallows to attempt nesting at neighboring barns where there was more water and mud for nest building. These nestings were total failures, as uncontrolled sparrows killed all of the young swallows at these farms.

After 1911, mud pools were made available for nesting swallows during dry years to prevent the birds from moving to other nesting localities. Despite this help, the population did not increase as rapidly as was expected. In 1926, A. W. Schorger (1931: 7) counted 456 nests on the barn. He says, "All but 38 were located on the east side of the barn. Here there were three and four tiers of nests. . . . Slats have been nailed horizontally to help keep the nests in place."

Later History

One of the most important management techniques necessary for successful Cliff Swallow management was learned by accident. During the spring of about 1928, a heavy rain washed most of the previous year's nests to the ground. New nests were rapidly built following the storm, and a great increase was noted in the size of the fall colony. Since the increase in population appeared to result directly from the construction of new nests, the old nests were knocked down the following spring by the use of a ladder and a long pole. Again nesting success appeared to be higher than in previous years; so thereafter the old nests were annually removed from the barn.

Examination of the removed nests showed that English Sparrows had carried many feathers into them and had occupied them during the absence of the swallows in fall and winter. Some of the nests showed that sparrows had begun to lay eggs in them before the swallows arrived. Many of the nests that contained old debris and feathers also contained dead swallows. Evidently the sparrows were directly responsible for heavy parasitism which caused considerable mortality among both the young and nesting parent swallows. New nests apparently were free of parasites.

This technique was very successful if mild weather prevailed after the first swallows arrived. However, a sudden drop in temperature after the swallows began to arrive one spring, caused insects to remain dormant and hence prevented swallows from feeding. All of the swallows remained flightless during the prolonged cold weather. Many of them perched in their partly-constructed nests waiting for warm weather. Exposure and hunger killed great numbers of the birds, while others

contracted diarrhea and died later. In telling me of the birds that had died, Mr. Bodeman said, "I picked up a milk pail full of the birds and took them to Deerfield so the people could see them." From that year to the present, only part of the old nests were knocked down before the birds arrived in the spring. If a sudden cold wave occurred, the swallows made use of the remaining old nests for protection. After nesting was well under way and the danger of low temperatures was past, all of the old nests were removed.

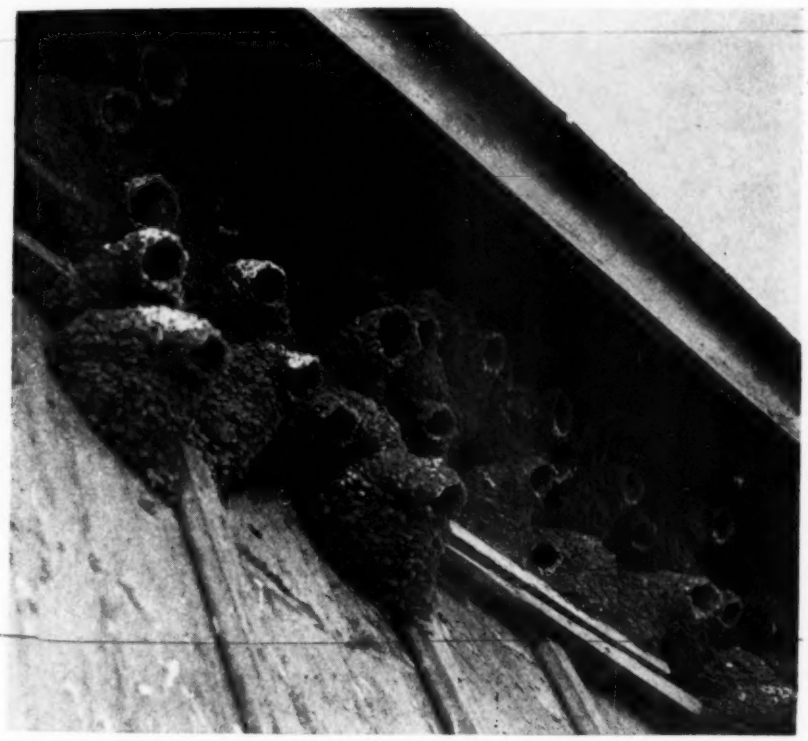

Figure 1. The use of horizontal strips for nesting. This is one of the most important techniques in Cliff Swallow management.

Before long it became apparent that the rapidly increasing swallow colony needed more room for nesting. In 1937, a two-inch horizontal strip was nailed on the barn 10 inches below the slats seen by Schorger in 1926. This gave the swallows an opportunity to extend their nests below those of the previous year, and gave them a secure foundation on which they could begin construction. A strip was placed on the opposite side of the barn the following year, and immediately the swallows utilized the entire strip for nesting. On July 21, 1940, about

1,200 nests were counted on the barn. On July 11, 1941, 1,970 nests were counted, and on July 14, 1942, 2,015 nests were counted. These counts are not accurate, as the number of nests that had fallen by July could not be determined, but they indicate that the colony is still increasing, for the number of fallen nests likely did not vary greatly during these three years.

Figure 2. East side of Mr. Bodeman's barn showing some of the 1,200 nests counted on July 21, 1940.

Nesting and Feeding

Some of the swallows are paired within a week following the arrival of the first birds. Nest building also begins at this time. Contrary to the belief of some observers, Cliff Swallows do not carry mud for their nests continuously. After enough mud has been brought and put in place to form about an inch of the nest, construction ceases while the mud dries. The length of the interval before construction continues is determined by the rapidity of drying. Cold weather causes a momentary halt in building whether or not the incomplete nest has dried sufficiently to enable additional pellets of mud to be added. I have observed intervals varying from one day to more than a week. As the nest nears completion, the amount of mud added per construction period decreases and the danger of breaking away part of the nest by building activity

increases. Accidents in construction may occur, but the fallen fragments are replaced rapidly. Part of the nest may be broken down during incubation, or after the young have hatched, but repairs are always made immediately.

T. S. Roberts (1932: 51) says, "The Eave Swallow's nest, in its perfect form, is a remarkable structure, but frequently the decurved entrance tunnel is imperfect or absent. The lack of reenforcing material, such as is used by the Barn Swallow, renders it very fragile when thoroughly dry. Both birds assist in the building and in the care of the young. The lining is often placed and the eggs laid before the completion of the nest. The pellets of sticky mud are gathered in the mouth, while the birds hover in the air with wings fully extended above the back." Although the wings are nearly always extended above the back while the swallows gather mud, they do not actually hover in the air. Considerable support is gained by placing their extended feet on the mud during this process. Some swallows were seen resting at the supply of mud, while most of them rested at the nest site. He adds that ". . . nests are partially superimposed upon one another; inside nests [are made] of bits of straw, grass, or feathers." Of the several thousand nests I have observed, all contained small quantities of straw, grass, or leaves, but practically none contained feathers. The nests that contained feathers were heavily lined with them, and obviously were feathered by sparrows. During the peak of nest building activity from five to 40 swallows were seen at one time selecting native grass and sedge materials from a hog house covered with hay cut in a nearby marsh, but no swallows were ever seen selecting materials from the oat and barley straw piles closer to the barn.

Four or five eggs are generally deposited soon after the mud dries, but as Roberts stated, they may be deposited before the nest is completed.

Some of the birds compete strongly for nest sites. In their competition they often fight, become completely engrossed in their struggles, and flutter to the ground where they are easily caught by cats. I do not know whether these are males or females, as the sexes are difficult to distinguish.

In spite of all efforts to shoot the sparrows that come near the barn, some succeed in laying eggs in the swallow nests. When this occurs, the swallow incubates the eggs and feeds the young. If a swallow chances to lay an egg in a sparrow-occupied nest, the sparrow refuses to incubate any of the eggs.

The growth rate of the newly-hatched sparrows is greater than that of the newly-hatched swallows; hence the sparrows soon dominate the young swallows, crowd to the nest opening, get nearly all of the food brought to the nest by the parent swallows, and eventually starve the young swallows. By listening for the characteristic calls of the young

sparrows from the nests, it is easy to locate the ones that contain these parasites. Breaking open the entrance of the nest reveals the emaciated swallows. After the young sparrows are removed, the nest is repaired and the swallows are adequately cared for.

In April, May, and June, the entire colony may leave the barn for two or more hours a day to feed. During these feeding periods the young are especially vulnerable to the onslaughts of sparrows. On one occasion Mr. Bodeman attended a circus in Madison and found that "sparrows had killed hundreds of young swallows" while he was gone. The young were pecked on the head, and in most cases dragged from their nests.

When insects were abundant close to the barn during the period of juvenile development, the adult birds did not go out together as a single group. In this case there was mutual association of the birds at all times, for there appeared to be a continuous flight of departing and incoming birds between the barn and the source of the insect food. The most conspicuous example of such feeding occurred while an alfalfa field was being mowed near the barn. A large group of birds constantly hovered over and behind the mower and caught the moths (*Noctuidae*) that were disturbed to flight by the sickle. Each bird seemed to be trying to get the maximum number of moths it could carry before departing for its nest. Frequently birds were seen dropping moths as they attempted to get additional ones in their mouths.

Post-nesting Period

Several writers have stated that Cliff Swallows commonly raise two broods of young in a season. During July, while the early-hatched young are spending most of their time on the barn roof, a few swallows may be observed incubating eggs. It seems more likely that these incubating birds are not raising a second brood but are re-nesting birds whose first nests fell from the barn.

Soon after the early-hatched young have reached mature size, they leave their nesting site with their parents. The size of the group varies according to the number of birds that began nesting early. From the time the first group leaves until the late-hatched young have grown to adult size, several groups may leave the nesting site. Each group apparently remains intact after leaving the nesting site but may congregate with Barn Swallows, Rough-winged Swallows, Tree Swallows, or Bank Swallows. These heterogeneous groups seek the open fields and ponds where food is abundant and go through a conditioning period preparatory to fall migration.

The nature and direction of Cliff Swallow dispersion from nesting sites is not understood. I believe that more Cliff Swallows disperse to the north of their nesting localities than in any other direction. The appearance of large groups of Cliff Swallows north of known nesting sites, following the nesting period, suggests this movement. Elton

Bussewitz informs me that nearly all Cliff Swallows recorded in the vicinity of Watertown (17 miles northeast of Mr. Bodeman's farm) were seen during July and August. During this same period I have been unable to secure swallow records for the region south of Mr. Bodeman's farm. Other records substantiate this observation. H. H. T. Jackson (1923: 486) saw "about 300 Cliff Swallows roosting on the telephone wires at Bent's Camp," Mamie Lake, Wisconsin, from August 22 to 28, 1917. He does not give earlier-season records for a large-sized group. All the Cliff Swallows I have seen during late July and August, in the latitude of southern Wisconsin were flying northward. It is possible that all Cliff Swallows in this region start northward and later, when they have finished their conditioning period, migrate southward over a more eastern or western route. Evidence for this northern movement is not conclusive, and banding studies will be necessary to verify or disprove it.

Management

The success of Cliff Swallow management depends largely upon the success of sparrow control. Its importance is pointed out by William Brewster (1906: 300) who says "the Eave Swallow suffers directly and very seriously from the encroachments of the House Sparrows who destroy its eggs and young and take possession of its nests whenever opportunity offers." T. S. Roberts (1932: 50), W. B. Barrows (1912: 544), E. H. Forbush (1929: 145), Joseph Grinnell (1937: 207), and Dayton Stoner (1939: 221) are among the numerous writers who have recorded similar depredations by the sparrow. Mr. Bodeman has found it advisable to shoot sparrows every month in the year. When the swallows arrive in the spring, less shooting is necessary to keep the sparrows under control. From April, 1941, to April, 1942, Mr. Bodeman shot 1,075 rounds of 22-caliber shot cartridges at sparrows. Estimating two birds for every three shots fired gives a kill of 717 sparrows. This estimate is probably low, for I have seen him shoot six consecutive sparrows without a miss.

Although mud may be carried for nest building as far as three-fourths of a mile, it should be made available close to the nesting site. Long-distance carrying often results in some of the swallows nesting in undesirable locations near the mud supply. Such nestings cause a reduced population due to the loss of all young and part of the adults. Mud pools should be made in the open where they are easily found by swallows and not easily approached by cats. Loam, silt loam, and clay loam (rather than sandy or gravelly soils) make the best mud for nest-building.

Once Mr. Bodeman fastened old Cliff Swallow nests to his machine shed and thus induced swallows to nest there. The machine shed never had nests on it prior to his experiment. He had done it only as an experiment and did not want the swallows to continue there, so at the end of the season he knocked down all of the nests and the swallows

made no effort to rebuild on the shed in subsequent seasons.

When colonies increase and nests are extended more than four feet below the eaves, more eaves or shelves should be added, as heavy rains may wash away nests that are not protected by the eaves.

The oil in paint does not allow mud to adhere to painted surfaces. If it becomes necessary to paint the barn occupied by nesting swallows, a strip should be left unpainted beneath the eaves on which the birds can fasten their nests. If painting the entire barn is necessary, an unpainted board or two may be nailed beneather the eaves for the swallows. Rough lumber is much better for nesting than planed lumber.

Chronology

April 13 to 25:	First Cliff Swallows arrive at Deerfield, Wisconsin. (Fly directly to nesting site).
April 30:	Last birds reach nesting location. (Some of the earliest arrivals are now paired).
May 1 to 15:	Early arrivals building nests. (Most birds have little or none of their nests constructed).
May 15 to 31:	Peak of nest-building activity.
June 10:	Most nests completed. (About five per cent still carrying mud).
June 1 to 10:	First eggs hatch.
June 10 to 20:	Period of most frequent hatching.
July 10:	Last eggs hatch.
July 20 to August 15:	Last birds leave nesting location.
July 20 to September 1:	Most birds preparing for migration. (Do not return to nesting location).
Sept. 1 to 15:	Most birds migrating southward.
Oct. 4:	Last birds leave Deerfield, Wisconsin.

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WISCONSIN CONSERVATION DEPARTMENT, MADISON, WISCONSIN

BIRDS ACROSS THE SKY. By Florence Page Jaques. Illustrations by Francis Lee Jaques. Harper & Brothers, N.Y. 1942: 5½ x 8 in., xiv + 240 pp., 25 pls. $2.50.

From the firm of Florence Page and Francis Lee Jaques, we have learned to expect art and artistry, charm and humor. In this, their latest effort, there is all of that. Ornithologists will find amusement in seeing how funny they sometimes appear to a layman, even a sympathetic one. Laymen will find enthusiasm and a very non-technical explanation of some of the strange antics of the trained "bird-man." No more understanding readers can be found than ornithologists' wives who, trained in other fields, have had ornithology and ornithologists thrust upon them with matrimony. They will confirm Mrs. Jaques' pictures of the patient efforts of the birdmen to educate which, nevertheless, leave the learner feeling well-nigh imbecilic and exasperated beyond measure. They will give joyful assent to her assertions that a richer and more absorbing life comes with a fuller acquaintance with the bird world. They will heartily endorse her descriptions of bird addicts as "some of the finest, most delightful and inspiring people."

Mrs. Jaques writes with facility, with a light philosophical touch, and with a sensitiveness not only to word sounds and meanings, but also to colors and situations. She differs from the bird census takers, perhaps also the taxonomists, by her acceptance of the bird as an individual, not as belonging to species or subspecies, tagged with absurdly long polysyllabic names. Her effort to describe sound and color effects is challenging, though it will convey varying meanings to different readers, as in "the gold-dark song" of the hermit thrush, or the "stainless sky."

Mr. Jaques has added greatly to the charm of the book with many delightful black and white drawings. Some are significant for their humor, others for sense of graceful movement, others for accurate characterization. His love of trees and his knowldge of them are beautifully exemplified in "Grey Fallodon" and "Deep Forest." As usual, Mr. Jaques' duck pictures are of especial interest.

Lovers of England and the English will find the chapter describing an English spring and the meeting with Lord Grey sharply disturbing when read in these harrowing times. Those who have read "Canoe Country" and "The Geese Fly High" will probably find Mrs. Jaques' sidelights on the American Museum of Natural History, and especially the description of her husband's method of planning the lovely exhibits, her joy in the dance of the woodcock, and the elation which the migration of the Blue and Snow Geese brought to her, of particular interest. "Birds Across The Sky" is not as even as the two preceding books, partly because it describes such various episodes and partly because it is handicapped by a "purpose to instruct." It lacks the lyrical quality of "Canoe Country" and the pure joyousness of "The Geese Fly High." In spite of these slight criticisms this book will bring gratification because of its many merits and because of the varied interests, the quick and sensitive feeling, and the joyful nature and warm sympathy of the author.—Helen Van Tyne.

INTERCOVEY SOCIAL RELATIONSHIPS IN THE VALLEY QUAIL

BY WALTER E. HOWARD AND JOHN T. EMLEN, JR.[1]

SOCIAL barriers between members of different coveys of Valley Quail (*Lophortyx californica vallicola*) have been observed and studied under natural conditions at Davis, California since 1936 (Emlen, 1939). In these studies it was noted that birds which wandered beyond the limits of their own covey range were strongly attracted to other groups of quail which they happened to encounter. Wanderers that attempted to mingle with a strange covey on its home range, however, were quickly singled out and driven off by the residents at each approach. Thus, in a mixed covey, alien birds were almost invariably found a few yards from the main body of natives.

Because of the possible significance of intercovey social barriers to problems of quail dispersion and distribution and to the general question of social organization in bird populations, it seemed desirable to obtain further information on intercovey relationships by experimentation. Accordingly a series of experiments was performed at Davis, California during the winter of 1939–40.

We wish to express our appreciation to Mrs. M. M. Nice, Dr. P. L. Errington and Dr. T. I. Storer for valuable criticisms and suggestions in preparing this paper.

EXPERIMENTAL

Experiments were conducted on three covey ranges (B, C, and D of Figure 1) where conditions for observation were particularly favorable. Additional birds for some experiments were obtained from three other ranges (A, E and F) in the neighborhood. Range B, although it had been occupied by a covey during the four preceding winters and was apparently in excellent condition, was vacant in 1939–40. This provided a site for two introduction experiments (Nos. 9 and 10).

All quail on the observation areas were labeled with showy field markers visible at a considerable distance; dyed chicken feathers "imped" (spliced by means of a corroded needle [Wright, 1939]) to clipped rectrices and a similarly colored celluloid band on the left leg designated covey membership; two celluloid bands of various color combinations on the right leg identified individuals within a covey.

The experiments were of three types: (1) those in which birds, singly or in groups, were transported from their native range to that of another covey; (2) those in which birds, singly or in groups, were temporarily withdrawn from their native range to be returned after varying periods of time, and (3) those in which birds from two sources

[1] Contribution from the Division of Zoology, University of California, Davis, Calif.

were introduced together into an unoccupied range. Observations on experimental coveys were made almost daily in the early morning and

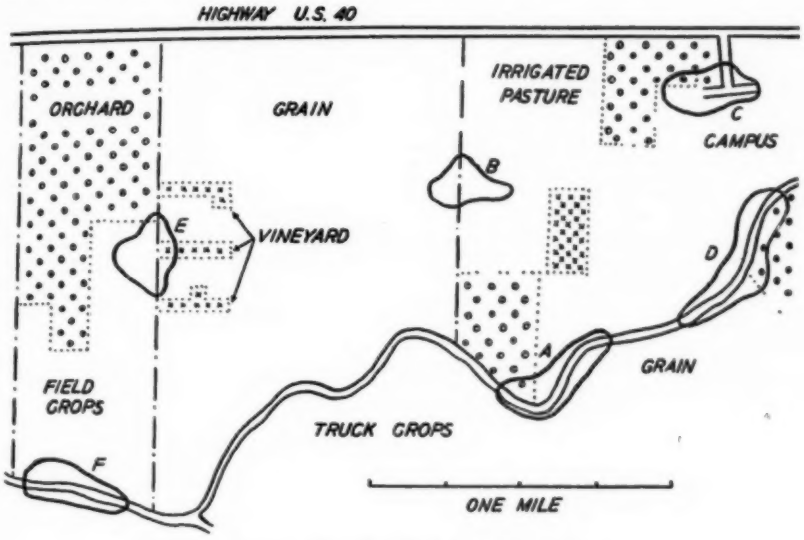

Figure 1. Covey ranges of Valley Quail.

late afternoon when activity was greatest. Ten experiments involving 29 experimental birds were completed before the breeding season (Table 1).

Results

Observations may be summarized under the following headings:

1. *Homing behavior was poorly developed in the quail under observation.* Of twenty-six birds transported from ½ to 2 miles from their native covey ranges, only two (Experiments 4 and 5) found their way back during the experimental period. These two homing records, furthermore, may have resulted from random movements rather than from a "homing sense," for in both cases the local distribution of cover favored movements in the direction of the original range. The low incidence of homing behavior of either a directed or a random type may be due largely to the strong and persistent attraction that an established covey exerts on a stray bird or group of birds (see next paragraph). The movement of the male in Experiment 4 may have been facilitated by a reduction in the flock bond, for this bird was already mated (see Experiment 3).

2. *Birds on a strange range were attracted to any group of quail they encountered.* During the winter season each quail covey at Davis

TABLE 1

OUTLINE OF EXPERIMENTS ON INTERCOVEY SOCIAL RELATIONSHIPS

Experiment	Bird	Experimental Procedure: Experimental treatment	From: Territory	From: Date	To: Territory	To: Date	Subsequent Behavior (Numbers in italics refer to days after start of experiment)
1a	♂	None (Natural movement)	A	1–9	D	1–10?	*6* to *16*, attacked frequently by native ♂♂, remains 5 to 10 ft.+ from covey (*9*, threatens a native ♀ attacking ♀ of expt. 1b); (*15*–, frequently attacks ♂ of expt. 2); *17* to *25*, attacked less frequently, approaches closer; *26* to *34*, not attacked by natives, still remains slightly apart from covey; *35*–, completely assimilated.
1b	♀	None (Natural movement)	A	1–9	D	1–10?	*6* to *16*, attacked by native ♀♀ and by ♀ of expt. 1c, remains 5 to 10 ft.+ from covey with ♂ of expt. 1a; *17* to *25*, attacked less frequently, approaches closer; *26* to *34*, not attacked, nearly assimilated; *35*–, completely assimilated.
1c	♀	None (Natural movement)	A	1–5±	D	1–6?	*10* to *20*, attacked by native ♀♀, dominates ♀ of expt. 1b, remains 5 to 10 ft.+ from covey, generally near ♂ and ♀ of expts. 1a and 1b; *21* to *28*, rarely attacked, nearly assimilated; *29*–, no further records (killed?)
2*	♂	Artificial transplant	C	1–23	D	1–23	*1* to *8*, attacked by native ♂♂ and ♂ of expt. 1a, remains 5 to 10 ft.+ from covey, roosts alone; *9* to *30*, attacked less frequently, approaches closer, roosts with covey (*26*, attacks ♂ of expt. 6a); *31* to *35*, not attacked, nearly assimilated; *35*, artificially removed for expt. 3.
3*	♂	Artificial transplant	D	2–26	C	3–1	*1* to *3*, attacked by native ♂♂, remains at considerable distance from covey; *3* to *14*, (paired) remains at considerable distance from covey with mate; *15* to *33*, associates quite freely with pairs of covey; *35*, artificially removed for expt. 4.
4*	♂	Artificial transplant	C	4–4	D	4–5	*1* to *3*, remains at distance from covey, calls much, dominates ♂ of expt. 6a as in earlier period of residence (expt. 2); *6*, has returned to territory C.
5	♂	Artificial transplant	D	2–7	C	2–7	*1*, runs to covey immediately on release, attacked by native ♂♂ after few seconds delay, retires and remains 20 ft.+ from covey; *3*, has returned to territory D.
6a	♂	Artificial transplant	E	2–17	D	2–17	*1*, attacked by native ♂♂ and by ♂ of expt. 2, retires, leaves territory; *33*, reappears, attacked by native ♂♂ (subsequent behavior confused by mating activity).
6b	♀	Artificial transplant	E	2–17	D	2–17	*1* to *15*±, attacked by native ♀♀, remains 5 to 10 ft.+ from covey; *16*± to *42*, not attacked but still incompletely assimilated; *44*, completely assimilated.
7	♂	Temporary withdrawal	D	1–23	D	1–24	*1*, released 50 ft. from covey, merged with them after 30 minutes, completely assimilated.
8a	♂	Temporary withdrawal	D	2–1	D	2–8	*1*, released 75 ft. from covey, merged with covey in 8 minutes and completely assimilated.
8b	♀	Temporary withdrawal	D	2–1	D	2–8	*1*, same behavior and reception as ♂ of expt. 8a.
9a	5♂♂ 6♀♀	Artificial introduction	F	2–15 & 16	B	2–16	Accept and remain on new (vacant) territory into nesting season.
9b	♂		E	2–15	B	2–16	*1*, (released with 11 birds of expt. 9a), not attacked but tended to remain apart from covey, roosts alone; *2*, not attacked but generally apart from covey; *5*, alone on territory; *7*, accepted by ♂♂ of expt. 10a, occasionally attacked by ♂♂ of expt. 9a, remains apart.
10a	3♂♂	Artificial transplant	E	2–21	B	2–22	*1*–, occasionally attacked by ♂♂ of expt. 9a, generally apart and scattered.
10b	2♀♀		D	2–21	B	2–22	*1*–, occasionally attacked by ♀♀ of expt. 9a, but generally accepted, tend to remain apart and scattered.

* Experiments 2, 3 and 4 all involved the same male bird. No other birds were used in more than one experiment.

acted as a focus of attraction for all quail entering its range. Birds appearing on a strange range (through natural wandering or experimental transplantation) approached and persistently followed the native covey for as much as a month or more, often in the face of active opposition (see next paragraph). Groups of 3 to 14 aliens were less strongly attracted to native coveys than were single individuals (Experiment 10; also Emlen, 1939: 120).

3. *Strange birds, alone or in small groups, were quickly recognized as aliens and forcibly excluded from intimate association in an established covey.* Members of established quail coveys at Davis were intolerant of strange birds appearing in their midst. Aliens, introduced or wandering onto an established covey range, invariably found their approach to the covey challenged by the natives. Aliens were never seen to resist these attacks and usually fled at the slightest display of animosity by a native.

4. *The active exclusion of aliens by members of an established covey gradually diminished and eventually disappeared.* Attacks on aliens were, in general, most frequent and vicious on the first day or two of association. Thereafter the intolerant attitude gradually diminished, falling off particularly after about two weeks. By the end of the fourth or fifth week attacks on aliens were rare, although one male in the spring of 1937 was still actively repulsed after the fifth week (Emlen, 1939).

5. *Quail from separate sources did not merge completely until they had "become acquainted."* Alien quail (single individuals or small groups) tended to remain somewhat apart from natives in their roosting and occasionally their feeding activities for several weeks after hostilities had subsided. This may represent a gradual trailing off of the initial native-alien antagonism, or it may be quite independent of it and indicate a hesitancy in these quail to mingle intimately with strangers until an "acquaintanceship" has become established. The latter interpretation is supported by observations in Experiments 9b and 10 in which two groups, established side by side on a range strange to both, demonstrated aloofness from each other with very little of the active antagonism of a native-alien relationship.

6. *Recognition of individuals as covey members was not affected by absences of a week, but was influenced by an absence of 38 days.* Birds withheld from their home coveys for periods of one day and 7 days in Experiments 7, 8a and 8b were immediately assimilated upon being returned. The male in Experiment 3, however, upon being returned to his native covey range after an absence of 38 days was treated as an alien. His acceptance into the covey was apparently more rapid than is usual with aliens, but this reaction may have been complicated by pairing behavior. After being returned to the range

of his second residence where he had become nearly assimilated in Experiment 2, this same bird was again treated as an alien, showing a considerable loss of recognition after an absence of 39 days (Experiment 4).

7. *Alien quail in a covey actively dominated birds of subsequent introductions.* When a succession of introductions was made into a single covey (Expts. 1b, 2, 6a, 6b) alien groups of longest standing attacked later arrivals much as they themselves were attacked by natives. This belligerent attitude toward newly introduced birds often seemed more vicious in partially assimilated aliens than in the established natives. The effect of this behavior was to establish an order of active dominance among the partially assimilated groups in a covey based on seniority of residence on the range. This order was modified in Experiments 4 and 10a where previous social relationship was apparently "remembered" and carried over.

8. *Aliens in a covey were attacked only by members of their own sex.* This feature of behavior, overlooked in the 1937–38 season, was checked almost daily on experimental birds in the present study. Only one instance of attack upon a bird of the opposite sex was noted, and this incident was of very brief duration. Observations did not start until mid-January, only a little over a month before traces of pairing behavior were detected, and it is possible that a low level of sexual activity was already present. Intra-covey fighting is rarely observed in midwinter at Davis, but when it has occurred (7 records in the past 4 years) it has always been between members of the same sex. In one instance (Dec. 4, 1937) a crippled female was repeatedly attacked by female covey mates but was not bothered by the males. These observations suggest that members of this sexually dimorphic species may be capable of sex recognition at all seasons of the year.

Discussion

Because of the difficulties involved in marking and observing under field conditions, very little is known concerning the inter-flock relationships of free-living wild birds. The phenomenon of a closed flock with domination of strangers, however, has been observed in wild Jackdaws, Rooks (Lorenz, 1931) and Chickadees (Odum, 1941: 118; Wallace, 1941: 53) as well as in the Valley Quail herein described. Similar behavior, furthermore, has been noted in flocks of a wide variety of captive animals. An initial attitude of intolerance towards newcomers by an established flock is well known to breeders of Valley Quail, Bobwhite Quail, Pheasants and other game birds; it has also been noticed in captive Song Sparrows (Nice, 1939: 260), White-crowned Sparrows, Spotted Towhees (Tompkins, 1933: 100) and various aviary species (E. C. Kinsey, personal communication). Domestic fowl, especially cocks, persecute new-comers, and precautions are often needed to pre-

vent the killing of an introduced stranger. A comparable initial domination of strangers occurs in herds of sheep, hogs, cattle, horses and various other herbivorous and carnivorous mammals (Alverdes, 1935: 195); it is also reported in wild Howling Monkeys (Carpenter, 1934: 100–104), and is characteristic of many human societies, both primitive and modern. Among invertebrates, ants (Wheeler, 1910: 182) and bees (Root, 1940: 52) are notably intolerant of strangers. A careless attempt to merge two bee hives by placing one upon the other without a separator may result in a conflict and "quarts" of dead bees (J. E. Eckert, personal communication).

When an encounter between strangers takes place on the home range of one of the contending parties, residents often hold an initial advantage over tresspassers (Nice, 1941: 469). In the Valley Quail studied at Davis, natives were invariably successful in their skirmishes with aliens. Differences in age, weight or physical condition definitely were not involved. It seemed rather that a quail on strange territory, and in the presence of strange birds, developed an attitude of subordinance which was quickly detected and capitalized upon by the natives. Three possible explanations for this behavior suggest themselves.

1. *Majority dominance.*—In all the observed instances of intercovey contact, the native group was larger than the alien group. It is thus conceivable that the assumption of dominance by natives was purely a matter of numbers. If this were the case, a large group of quail introduced into the range of a small covey would dominate the latter through sheer "weight of numbers." Unfortunately this critical experiment has not yet been performed. Two incidents, however, provide pertinent information. On November 15, 1936, an alien group of 14 birds wandered onto the range of a neighboring covey which contained 23 birds. Although these invaders did not constitute a majority of the combined covey, they represented a sizeable unit, which conceivably could have disputed for dominance in a majority-ruled order. No such dispute occurred; the aliens all assumed an attitude of subordinance and retired to themselves (Emlen, 1939). Experiment 9 (Table 1) of the present study was designed to test the "majority rule" theory by placing unequal numbers of birds from two covey sources together on an unoccupied covey range. In this synthetic covey the single male from source E, although refraining from intimate association with the 11 birds from source F, was seldom chased and did not exhibit the avoiding reaction characteristic of aliens on unfamiliar territory. The subsequent introduction of 3 more birds from source E in Experiment 10 made no appreciable change in this picture of loose association without definite group dominance.

These two observations do not eliminate majority dominance from the picture; they suggest, however, that territorial associations were more important than numerical inequalities in determining dominance rela-

tionships between natives and aliens in these mixed quail coveys.

2. *Territorial dominance.*—In species showing territorial behavior, aliens are attacked and driven out as a part of territory defense, the territory owner showing nearly complete local dominance over trespassers (Howard, 1920: 97; Tinbergen, 1939: 57; Lack, 1939: 177; Nice, 1941: 469, 470). Territory in the sense of a "defended area" (Noble, 1939: 267), however, does not help to explain the native-alien relationship in Valley Quail. With the exception of some unmated males during the nesting season, quail at Davis have never been observed to exhibit anything that resembles proprietory behavior toward a piece of land. Aliens are not molested on a covey range until they approach the covey itself. The chase which follows such an approach is typically short and directed merely away from the body of the covey, not across any territory boundary.

3. *Seniority of residence dominance.*—In observations at Davis the natives of a covey (the group in longest residence on the area) always acted as the dominant group. Where two or more successive introductions were made into an area, the order of dominance followed the order of introduction except as previous associations of the birds modified it. Where unequal groups from two independent sources were liberated together on an unoccupied range, inter-group dominance was essentially absent. This suggests that seniority of residence on a range may be a decisive factor in determining the dominance of natives over aliens.

The favorable psychological effect of "being locally established" has been demonstrated in various territorial species and in laboratory animals. Schjelderup-Ebbe (1935: 967) observed it and described it in detail for the domestic fowl. Whitman (1919) and Shoemaker (1939) detected it in doves and canaries, respectively. Noble, Wurm and Schmidt (1938: 23) showed that in non-breeding pigeons, a low-ranking bird after becoming established in a small cage by itself assumes a local dominance over superior pigeons subsequently introduced into the cage with it. Diebschlag (1941) found that when a flock of pigeons was moved about from cage to cage the dominant role shifted from one individual to another according to the cage occupied. Such locality-linked dominance has often been interpreted as a form of territorialism. Diebschlag, however, found that each male pigeon in a cage defended nothing beyond its resting place and that the area surrounding this small inviolate territory often served as a sort of buffer ground on which other birds were tolerated but dominated. Confidence gained through familiarity with the area seemed to be fundamental to the degree of dominance achieved.

In free-living Valley Quail, although the site of an encounter definitely influences the outcome, there is no evidence that territory, *per se*, provides the incentive for aggressive behavior. The dominating attitude

of established residents over aliens may better be attributed to confidence gained through familiarity with the topographical and vegetational features of the covey range. A bird suddenly released into unfamiliar surroundings is conceivably placed at a psychological disadvantage. In a peck-right society any such handicap would affect the social reactions and hence the position of a bird in the social order. Covey range may well be an adjunct to social aggressiveness without being an objective. This would seem to be the case in the quail population under study.

Summary

A series of experiments designed to test the social relationships between members of different coveys of Valley Quail at Davis, California confirm earlier observations that social barriers of non-recognition and active exclusion discourage inter-covey mixing. It was further noted in the experimental coveys that strangers were attacked only by birds of their own sex (observations between January and April), that active exclusion gradually subsided with continuous association, that unacquainted birds did not mingle freely even in the absence of active exclusion, and that partially established members of a covey dominated aliens of subsequent introductions. It is suggested that the dominance of aliens by established residents is in large degree related to a favorable psychological attitude gained through familiarity with the physical features of the covey range. Aliens acquire the "confidence" fundamental to social recognition only after a period of residence on the range.

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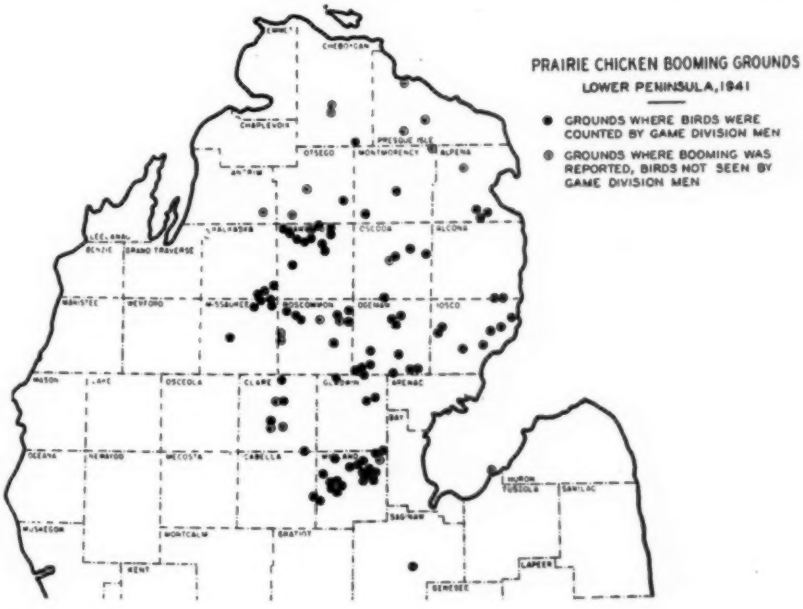
A PRAIRIE CHICKEN BOOMING GROUNDS SURVEY IN CENTRAL MICHIGAN

BY DONALD W. DOUGLASS

THE Greater Prairie Chicken (*Tympanuchus cupido americanus*), an important game species in northern Michigan, attracts scientific and popular attention because of its picturesque and colorful courtship display. This display, commonly known as "booming," from the sound produced at the climax of the performance, is useful to field men attempting to determine numbers of birds on an area, since it renders the birds conspicuous and easy to approach.

When male Prairie Chickens are actively booming, the investigator may drive through suitable country stopping every half mile or so to listen for the sound, which under extremely favorable conditions has been heard four miles away. Direction of the sound from successive listening posts, together with varying intensity, guides the observer to the booming ground. In northern Michigan, at least, the grounds can



frequently be reached by car, since suitable clearings are usually associated with roads or trails. In effect, the car serves as a movable blind to which the cocks, intent on their display, are largely indifferent. From the car an accurate count can often be made of the birds on the site.

Actively displaying birds are males; some males, however, may be

quiet, and therefore indistinguishable for the time from females. Since inactive birds are easily overlooked, total counts should be made by flushing the chickens from the booming grounds. When a booming ground must be approached on foot from a distance, less accurate counts are to be expected, as the birds often flush before the investigator obtains a good view of them.

In 1938, field men of the Game Division, Michigan Department of Conservation, made a survey of Prairie Chicken booming grounds in the northern part of the state. In no sense complete, it nevertheless promised well for the method. A similar survey was carried on in 1940, and a much more complete effort was made, with increased personnel, in 1941. Distribution of the booming grounds found in the Lower Peninsula by this latter survey is shown on the accompanying map. I believe that the map represents the main breeding range of the species in the Lower Peninsula. The western limits, however, are not yet clearly defined as the strip from western Isabella County to Grand Traverse County and northeastward to Emmet County needs more detailed study. Certain "holes" in the map represent areas that merit more attention.

These "holes" were to have been filled in in 1942, but travel curtailments restricted the work to a partial check of the 1941 observations. Since the 1941 data are the most complete available, they may be summarized briefly:

Birds were counted by Game Division men on 85 booming grounds; 21 additional sites shown on the map were reported by other observers or were approximately located by the sound of booming, but were not actually visited. A total of 472 males, 57 females was reported from the 85 grounds, but sexes were not always distinguished accurately. Totals represent maximum counts, since 40 booming grounds were visited more than once. While five was the most commonly reported number of cocks present on a single site, two of the grounds had only one present and nine only two. These single birds were observed only once each and possibly were not on established grounds; all but three of the instances of two birds on a site represented two or more observations. The maximum number of males on a booming ground was 31.

Of the 85 sites visited, 32 were on a knoll or hill, the remaining 53 on level ground, of which 11 were low and wet. Seventy-one of the grounds were within a mile or less of cultivated fields, 53 within ¼ mile, and 25 on cultivated land. The sites were generally open, mostly covered with sparse grass or other herbs; only 24 of the grounds showed woody growth other than sweet fern. Such woody growth consisted chiefly of scattered shrubs or small trees typical of the surrounding country.

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THE WILD TURKEY IN EARLY WISCONSIN

BY A. W. SCHORGER

IT is patently incongruous that a strictly American bird should receive the name Turkey, so a brief explanation of the appellation seems desirable. During the Middle Ages most of the strange and exotic forms of plants and animals came to Turkey from India by caravan and were then shipped to the various European nations. The bird or plant was then called after the country in which it supposedly originated. Our native maize became Turkish wheat. This is by no means an obsolete custom. The Hungarian Partridge (*Perdix perdix*) is not peculiar to Hungary, yet since the birds introduced originally into America came from that country it will be called Hungarian, probably, until the end of time. The Spanish brought to Europe the Mexican race of the Turkey and it is from this stock that our domestic fowl descended. Nevertheless, it was destined to be known as the Turkey or Indian Bird. The Spanish call the Turkey *gallo de India* (Indian cock) or *pavo*, while in France it is known as *coq d'Inde* (Indian cock) or *dindon*.

These preliminary remarks have a direct bearing on the subject, for in attempting to determine the early status of the Eastern Turkey (*Meleagris gallopavo silvestris*) in Wisconsin, the nomenclature is found to be somewhat confusing. Father Hennepin [1] was on the Upper Mississippi in 1680 and his statement that Turkeys occurred at Lake Pepin has been quoted frequently. In his books of travels the terminology becomes decidedly mixed. He mentions that while near Lake Pepin his party killed seven or eight large Turkeys (*coqs d'Inde*). This might be an acceptable statement had he not mentioned, a few pages beyond, that the Indians were very desirous of obtaining guns, having seen three or four Bustards or Wild Turkeys (*Outardes ou Coqs d'Inde*) killed at a single discharge. Here the *Outarde* or *Bustard* becomes synonymous with Turkey. In other parts of his book, it is perfectly clear that both *Coq d'Inde* and *Outarde* do not refer to the Turkey. Lahontan,[2] who came to Canada in 1683, mentions that he hunted the *Outarde* or *Bustard* on Lake Champlain and used decoys set in the water for this purpose. No amount of wishful thinking could place a Turkey in this situation. The bird that he was hunting was unquestionably the Canada Goose, for *Outarde* is the name by which this species is known in Quebec to this day. Michaux [3] shot a Canada Goose at the mouth of the Cumberland River on September 16, 1795, and states that both the French of Illinois and Canada call it Bustard (*Outarde*). Jonathan Carver [4] (1766) added to his personal observations by pilfering from Hennepin and mentions likewise the occurrence of Turkeys at Lake Pepin. In the absence of further authority, we are forced to the conclusion that Hennepin's Turkeys were Canada Geese.

Usually there is a logical basis for the use of these seemingly peculiar names. I spent considerable time on their possible derivation. The early explorers naturally would call the new American animals by the names of the creatures in Europe that they resembled most closely. The *Outarde* or Bustard is a large stocky bird. The spreading of the tail and other phases of courtship demeanor give it a decided resemblance to the Turkey. Only speculation can be offered for the synonomy of *Outarde* and Canada Goose. It was mentioned above that one of the French names for the Turkey is *Dindon*. The latter when used figuratively, as in paying a compliment to a human being, means a goose. Further investigation of the popular nomenclature by which the Turkey, Canada Goose, and Bustard may be one and the same bird will be left to a person more skilled than I in genetics.

It would seem that the French had muddled the nomenclature sufficiently without additional assistance; yet during the last century there is found a distinctly American contribution. The Sandhill Crane became known as Turkey or Northern Turkey in the region of the Upper Mississippi Valley. The name is heard seldom today except in the prairie provinces of Canada. John Lewis Peyton [5] was in northern Wisconsin in September, 1848, and mentioned seeing "some wild turkeys" while crossing a plain between LaPointe and the St. Croix River. A hunter in St. Croix County, in 1889, returned home bearing proudly a Wild Turkey that he had killed. Considerable persuasion was necessary to convince him that the bird was a "crane".[6]

Another obvious error is to be found in the reports [7] of a Wild Turkey having been killed when in reality, or in all probability, it was a domestic bird that had wandered into the timber. As an example, the following letter written at Osceola, Polk County, by an irate farmer under date April 7, 1868, will be quoted in part:

"Mr. Editor:

. . . They may be wild turkies, but if so, they must have run wild the day before he killed them, for at that time they were my *tame* turkies . . .

[Signed] Frederick Greenwold."

In this paper the range of the Turkey will be traced from the northeastern section of the state to the southwestern. Elizabeth Sellentin [8] came to Green Bay in 1837 and stated that the bird served on Christmas day was the Wild Turkey, "the most beautiful of American birds," and not the domestic one. This statement is not entirely satisfactory since a Turkey could be transported from a considerable distance to the southward during a Wisconsin winter. Fortunately there is corroborating evidence from the approximate latitude of Green Bay. Mrs. Mary Bristol [9] came to Green Bay in 1824 and during her six years of residence attended a wedding at Grand Kaukaulin (Kaukauna).

There were served for supper "all kinds of wild meat . . . turkey, quail . . . and porcupine with the quills on." The problem in this case was to fix the date of the event. It was found that the wedding was that of Margaret Grignon and that it took place in June, 1829. It is unlikely that at this season game could have been transported any great distance without spoilage. Incidentally, the Menominee Indians have lived in the Green Bay region ever since their first contact with the whites, and they had a Turkey clan.[10]

Figure 1. Range of the Wild Turkey in Wisconsin.

One of the earliest and best records for the occurrence of the Turkey in the vicinity of Lake Winnebago is due to the Jesuit, Allouez.[11] In April, 1670, he visited the Fox Indians who then resided at Lake Winneconne on the Wolf River. He wrote: "There we saw two Turkeys perched on a tree, male and female, resembling perfectly those of France —the same size, the same color, and the same cry." This statement is too circumstantial not to be accepted at full value. He uses the name *coqs d'Inde*, and the fact that they were sitting in a tree eliminates the Canada Goose and other aliases.

Richard Dart [12] arrived at Green Lake, Green Lake County, in 1840 and he states: "There were likewise wild turkeys and plenty of geese." In spite of the early establishment of Fort Winnebago at Portage there

is no definite statement of the occurrence of the Turkey. Mrs. John H. Kinzie [13] who came to reside at the fort in 1831, mentions that the Indians used "feathers of the wild turkey" as ornaments in the hair. These feathers might have been obtained by trade or brought from a distance. For example, St. Pierre [14] wrote from his fort at Mount Trempealeau that on May 6, 1736, a party of Sioux warriors was travelling down the Mississippi for the ostensible purpose of hunting Turkeys to secure feathers for their arrows. This letter is further indication also that these birds did not occur at Lake Pepin or even as far north as Trempealeau County.

The surveyor, William H. Canfield,[15] came to Sauk County in 1842 and was attached to the government survey of 1842–43. He had a keen interest in natural history and, in his list of the birds of the county, states that the Wild Turkey occurred formerly. The adjacent county of Richland had large numbers of Turkeys. Judge James H. Miner [16] mentions that when the towns of Willow and Richwood were first settled deer and Turkeys were exceedingly plentiful and furnished the principal meat supply of the early settlers. Mr. Aldo Leopold [17] was informed by George Johnson, district game warden at Richland Center, that he had discussed frequently the early status of game in the county with the Winnebago Indian, Good Bear. Good Bear stated that he had killed Turkeys along the Pine River, presumably while a young man. He died at Kilbourn in 1930 at the reputed age of 103 years.

The notable traveler, H. R. Schoolcraft,[18] was at Prairie du Chien, Crawford County, in 1820, and recorded the Turkey as common along this part of the Mississippi. An army officer [19] stationed at Prairie du Chien wrote on August 23, 1847: "Turkeys and deer are plenty in the woods."

An extension westward of the northern boundary of Crawford County would coincide nearly with the boundary line between Iowa and Minnesota. The latter represents the northern limit of the range of the Turkey west of the Mississippi until the Missouri River is reached.

The Turkey was abundant at times along Lake Michigan at least as far north as Port Washington. Just why the species ranged so much farther north, to Green Bay, in the eastern part of the state than in the Mississippi Valley is difficult to explain. The beech tree has a rather narrow range in eastern Wisconsin but occurs entirely around Lake Michigan. It is possible that beech nuts, of which Turkeys are very fond, combined with a succession of mild winters may have tolled the birds farther north here than elsewhere.

The first mention of Turkeys along Lake Michigan is due to Father Marquette.[20] On November 23, 1674, his canoe was beached at the Milwaukee River. He wrote: "Pierre shot a deer, 3 bustards (*outardes*) and three turkeys (*coqs d'Inde*)." There is no confusion here. Pierre killed three geese and three Turkeys. In October, 1679, Hennepin,[21]

who was with LaSalle's party, mentions that their men "killed some very fat Turkey hens" * in the region between Racine and Kenosha.

Andrew Vieau [22] came to Port Washington, Ozaukee County, in the spring of 1838. At that time his only neighbors comprised a single family at Saukville. He mentions that during the following winter he took by ox-team loads of "turkeys, venison, and other game" to Milwaukee for sale, in which enterprise he was very successful.

Wild Turkeys and other game were so abundant in the market in the "village" of Milwaukee in January, 1839, as not to be considered a luxury.[23] A. W. Kellogg,[24] came to Milwaukee in January, 1837, and mentions the killing of three birds out of a flock of Turkeys found on the farm at Kellogg's Corners. The species is mentioned as plentiful in 1839 when Martha E. Fitch [25] arrived in the village. The last Wild Turkey killed at Milwaukee is stated to have been shot by Dr. E. B. Wolcott in the First Ward in the winter of 1839.[26] It is doubtful if this was the last Turkey killed in the vicinity for in December, 1842, there appears the enthusiastic statement: "There are more Turkies, Venison, and other wild game to be found in Wisconsin than in any Territory in the Union."

During the winter of 1827–28, John H. Fonda [27] made a trip from Green Bay to Fort Dearborn (Chicago). He found Indians starving in their village on Lake Michigan, in Kenosha County, "though the country was teeming with deer, wild turkies and elk." Wild Turkeys were mentioned in 1844 as occurring near Racine but they were "by no means abundant." [28] Dr. P. R. Hoy [29] states that they were once very plentiful. The last occurrence for Racine was in November 1846, when a small flock that appeared was hunted with such energy that all the birds were killed. In 1853 he considered them as still abundant in the southwestern counties. A. C. Barry,[30] of Racine, did not mention the Turkey in his list of birds published in 1854. It had become so rare that an inhabitant of Racine, on receiving an Illinois Wild Turkey in December, 1859, mentions that it was the first that he had ever seen.[31]

Walworth County once had Wild Turkeys in considerable numbers. Charles M. Baker [32] is authority for the statement that in October, 1836, a flock of fourteen was seen in the town of Spring Prairie. A year or two later some birds were killed from a flock of about thirty that wintered in the town.

Turkeys existed at Lake Koshkonong as late as 1842, according to Thure Kumlien who settled there in 1843.[33] The only resident I know who had seen a native Wild Turkey, was H. L. Skavlem † of Janesville.

*The reading is: "Nos gens tuoient de leur côté des poules d'Inde fort grasses & enfin le dixhuitiéme du mois. . . ." The second London issue of 1698 reads differently: ". . . our Men [killed] a great many Turkey-Cocks very fat and big, wherewith we provided ourselves for several Days. . . ."

† H. L. Skavlem was born in the town of Newark, Rock County, October 3, 1846 and died at Janesville, Wisconsin, January 5, 1939. He resided in the town of Newark until 1880.

He wrote to me on January 29, 1929, that he had the distinct memory of seeing Philip Goss carrying a large Wild Turkey that he had shot, and showing it to his father. This is probably the bird killed in the town of Newark in 1854 and mentioned by him as the last record for Rock County.[34] It may not have been the last county record. His son, L. N. Skavlem,[17] informs me that his mother was born in the town of Plymouth, Rock County, March 30, 1851. She remembered, when a child, that a man stopped at their home with two Wild Turkeys tied by the legs and thrown over his shoulder.

The town of Verona, Dane County, was settled in 1837. Bears and Wild Turkeys "were very plenty for a few years after the first settlers came." [35] In 1934 and 1935 I interviewed several of the old residents of Green County. Mr. Sylvester Belveal, aged 84 at the time, stated that his mother came to Green County in 1834. The farm was in the "Richland timber." One spring during the maple sugar season she assisted in the capture of a large Wild Turkey. Mr. Willis Ludlow, of Monroe, informed me that his father, A. Ludlow, began his business career by buying merchandise in Chicago and transporting it by wagon to Fort Winnebago (Portage) for sale to the soldiers. He camped by the way and told of seeing Wild Turkeys between the present sites of Monroe and Portage. Turkeys were at one time very common in Stephenson County, Illinois, that borders Green County. John H. Thurston [36] tells that Charley Pratt killed seventeen young Turkeys one day in early fall within two miles of Freeport.

Charles Rodolph [37] located at Fort Hamilton, now Wiota, Lafayette County, in 1834. At that time there was an abundance of "deer, . . . wild turkeys, grouse . . ." W. R. Smith,[38] who was in the lead mining region in 1837, did not see any Turkeys but was told that they were numerous in many parts of the territory.

The highest density of Turkey population occurred undoubtedly in southwestern Wisconsin in the county of Grant. James Lockwood,[39] who came to Prairie du Chien in 1816, said: "It was not an uncommon thing to see a Fox Indian arrive at Prairie du Chien with a hand sled, loaded with twenty or thirty wild turkies for sale, as they were very plenty about Cassville, and occasionally there were some killed opposite Prairie du Chien." At that time the Fox Indians had a large village, called *Penah* (Turkey), on the present site of Cassville. In 1828, Fredrick G. Hollman [40] settled at Platteville. Bear, deer, and wild Turkeys "were to be found in astonishing quantities." Daniel R. Burt [41] mentions the killing of a fine Turkey along the Grant River, near Burton, in December, 1835. At that time flocks numbering from ten to forty birds were to be seen by going a short distance into the timber. As late as 1856, Wild Turkeys sold for as little as twenty-five cents apiece in the streets of Lancaster.[42]

The Turkey was almost extinct in Wisconsin by 1860. Dr. Hoy [43]

mentions that one was shot in Grant County in the fall of 1872. The last record of possible acceptance is the statement that one flew over the village of Darlington, Lafayette County, in May, 1881.[44] It is probable that this bird came from Jo Daviess County, Illinois, just to the southward. Statements [45] that the Turkey was to be found commonly in Wisconsin at this time are erroneous.

The scarcity of records for the last half of the past century is due to several causes. A large portion of southern Wisconsin was originally prairie, but it would be an error to assume that the Turkey did not use this type of terrain. During summer and early fall it wandered freely into the prairies and oak openings, but during the remainder of the year stayed rather closely to timber. Abel,[46] writing of Wisconsin and Iowa, in 1838, says that on the prairies "you will find thousands of prairie fowls, wild turkeys, . . .". Thurston [36] came to Rockford, Winnebago County, Illinois, in 1837. This county was largely prairie and he mentions that Turkeys were plentiful in the timber along the Pecatonica River, elsewhere being seldom seen. A more important factor affecting our information was the severe winter of 1842–43 when the species was nearly exterminated. It was about this time that the agricultural development of Wisconsin was well under way and soon there were very few Turkeys remaining for incoming settlers to see. It is for this reason also that there is little value in mentioning the negative evidence I obtained during the past decade from many pioneers.

The near extinction of the Wild Turkey is stated succinctly by Dr. Hoy: [43] "I am told, by Dr. E. B. Wolcott, that turkeys were abundant in Wisconsin previous to the hard winter of 1842–43, when snow was yet two feet deep in March, with a firm crust, so that the turkeys could not get to the ground; they hence became so poor and weak that they could not fly and so were an easy prey for the wolves, wildcats, foxes and minks. The Doctor further stated that he saw but one single turkey the next winter, and none since." The above winter was known in Wisconsin for decades as the "hard winter."

I will advance at this point a supposition termed the *reservoir* theory. It is axiomatic that a species is most vulnerable on the border of its range. If this were not the case, the border would not exist. Over a long period of years the numerical status of a species is subject to ebb and flow due to weather, food supply, disease, or other causes. Extensive study of early ecological conditions in Wisconsin leads to the conviction that at least three of our native species of birds, the Pinnated Grouse, the Quail, and the Wild Turkey, maintained a foothold in Wisconsin only by virtue of periodic replenishment from Illinois.

The Wild Turkey is a perfect example for the theory. It has been shown above that this species at times ranged as far north in Wisconsin as Green Bay. This extension would be rendered possible by a succession of mild winters. There must have been numerous occasions when

the Turkey was extirpated, or nearly so, due to the severity of the winter. It was mentioned above that Marquette landed at the mouth of the Milwaukee River on November 23, 1674. Though so early in the season, it was cold and over a foot of snow covered the ground. He went on to the present site of Chicago to spend a winter marked by intense cold and deep snow. He wrote in his diary on December 12: "We contented ourselves with killing three or four turkeys, out of many that came around our cabin because they were almost dying of hunger." All animals were affected by the extreme weather and, by the latter part of February, the deer were so lean as to be unfit for food. Since this condition prevailed at Chicago, it is probable that most of the Turkeys in Wisconsin perished during that season.

Direct evidence in support of the theory has been found. In December, 1852, a party of Milwaukee hunters went to Rock Prairie, Rock County. In the course of their hunt they killed seven Wild Turkeys, the largest of which weighed 14 pounds and 9 ounces. The point of most interest is the statement that Wild Turkeys "in droves" had entered Wisconsin due to the noise and hubbub of railway construction in northern Illinois.[47] That this was the cause for the immigation is open to grave doubt. The important thing is that the Turkeys came. Had primitive conditions prevailed, it is seen easily how Wisconsin would have been restocked.

The recent attempts [48] to reintroduce the Wild Turkey are not new. In 1887, two pairs of Wild Turkeys from the Indian Territory were brought to Lake Koshkonong by Mr. Gordon and released in the woods to breed under natural conditions.[49] In 1890 the estimates of their number varied from 23 of pure stock to more than 200 of pure and mixed stock.[50] Hunters secured "Wild Turkeys" in the vicinity up to 1892. In April of this year a bird weighing eighteen pounds was killed by August Lalk.[51] The difficulty was that the Turkeys wandered away in small flocks and never returned. Aside from lack of suitable environment, disease, and the tendency for the Wild Turkey to become semi-domestic, it is doubtful if a planting will ever become successful in Wisconsin. Biologists have learned that every species requires a certain minimum population to overcome natural hazards and maintain existence. In the case of the Wild Turkey, there are no longer reserves to the southward.

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The Pigeon. By Wendell Mitchell Levi. Printed at Columbia, S. C., 1941: 8 x 11 in., xxxii + 512 pp. (profusely illustrated). With preface by Dr. Oscar Riddle. Published by the author at Sumter, S. C. $10.00.

Persons interested in wild birds from the standpoint of field study or merely love of the outdoors are apt to have little use for wild birds in captivity or for those which have been domesticated. A bird is a bird, however, no matter where it is or how much it may have been altered by generations of breeding under man's care and direction. For this reason, serious students of bird biology will recognize that the way birds react under any conditions may contribute enlightenment on their behavior, variation, physiology, and characters in the wild.

The ordinary book on domesticated birds deals almost entirely with empirical details of care and management and pays little attention to the underlying principles involved. Levi's book, "The Pigeon," however, is not an ordinary book. It does not deal so much with details of the breeds and their "standards" as have numerous works in the past, but no previous book on pigeons has treated so comprehensively the scientific aspects of the genetics, physiology, and behavior. In these fields the coverage is surprisingly thorough, and the bibliographic references will prove of the greatest value to anyone desirous of pursuing the subjects further. The discussion of such subjects as the sex ratio, mortality, homing, and the like should prove especially pertinent to students of bird ecology.

Other parts of the book will be of more interest to pigeon raisers and fanciers, but they also contain much of more general interest. Such chapters are, of course, those which deal with the differentiation and breeds, the anatomy, care and feeding, and diseases and their control. In short, this is a book which any bird student would do well to have at hand for reference.—Leon J. Cole.

GROWTH AND DEVELOPMENT OF ENGLISH SPARROWS *

RICHARD LEE WEAVER

THIS study was made on the campus of Cornell University during the summer of 1937. Due to the heavy concentration of English or House Sparrows (*Passer domesticus*) around the Agricultural buildings, augmented by the presence of 75 nesting boxes, a great amount of material was available for study. The nest sites were visited each day during the nesting season and the young were measured, weighed and examined at approximately the same hour. Most of the work was done between the hours of four and six in the afternoon. More than 2,500 measurements were taken on young birds during the course of the study.

Description of Newly Hatched Young

Contrary to Dwight's (1900:171) statement, English Sparrows have no natal down. They are entirely naked when hatched, as was later pointed out by Boulton (1927).

The feather tracts of the dorsal surface are discernible as blue lines under the skin but the skin is unbroken anywhere by feathers. The eyes are closed and the ears appear to be so. The body has a pinkish-flesh color except for the white edges of the bill and the white toe-nails. The organs of the abdomen show clearly through the skin, and the lungs appear somewhat lighter in color in the region of the thorax. The head and the dorsal surface of the wings appear just a trifle darker than the rest of the body.

Although the margins of the bill are almost pure white, the center is horn- or straw-colored, capped by a similarly colored egg tooth. The interior of the mouth is bright red.

Changes in the Young from the Second to the Fourth Day

Little change occurs in the second and third days, except that the feather tracts are much darker, and the points of the primaries have become evident on the posterior borders of the wings. By the fourth day the skin over the eyes has broken. The interior of the mouth is duller in color. The edges of the bill are now lemon yellow. All of the feather tracts are traceable. A continuous dark band extends from the nares over the head and down the middle of the back to the tail, outlining the capital and spinal tracts. The primaries project through the skin one to two millimeters. There is no evidence of the yolk mass. The ears are more evident now as small round holes. The general appearance of the bird is dark gray due to the developing feathers under the skin.

* Submitted in partial fulfillment of the requirement for a minor thesis for a Doctorate at Cornell University September, 1938 and presented in part at the annual meeting of the Wilson Ornithological Club at Indianapolis, December 27, 1937.

Fifth, Sixth, and Seventh Days

The eyes are open by the fifth day. By the sixth day the young are half as heavy as when they leave the nest. Many of the contour feathers are through the skin on the sixth day. Marked changes occur in the appearance of the young birds by the seventh day after hatching. Feathers are breaking through the skin in parts of all of the feather tracts. Many of them, especially in the ventral tract, lose their sheaths immediately. The bird appears generally slate gray. The narrowing apteria appear flesh-colored. In the alar tract, the secondary coverts, and other

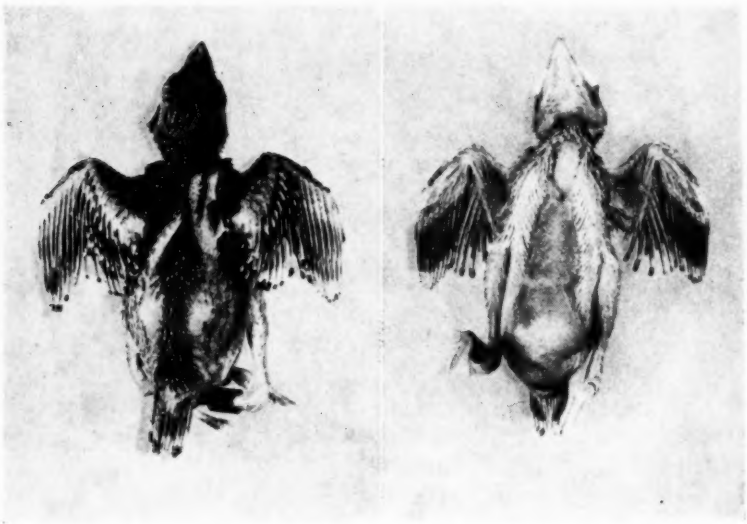

Figure 1. English Sparrows 6½ to 7 days old.

small feathers on the anterior and proximal portions of the wing are coming through the skin and unsheathing as they appear. These feathers are tipped with brown. The alula is 3 millimeters in length.

The primaries average 6.6 millimeters in length and have unsheathed one millimeter. The primary coverts are about 4 millimeters long and largely unsheathed. Three rows of feathers in the humeral tract have broken through the skin on the dorsal side of the tract and are unsheathed. On the anterior portion of the capital tract just above the bill the feathers are through the skin .5 millimeter, while only breaking the skin in other parts of the tract. The feathers in the cervical region of the spinal tract have projected through the skin 1.5 millimeters and are slightly shorter in other parts of the tract.

All of the feathers in the ventral tract have broken through the skin and are unsheathing as they appear. The rectrices are 5.3 millimeters long and are unsheathed only at the tips. The undertail coverts measure 1.5 millimeters and are white. All of the feathers in the femoral tract have broken through the skin, but few in the crural tract have appeared although they are very dark. The eye and ear openings each measure 3 millimeters.

Eighth and Ninth Days

The most noticeable change during these two days is the acquisition of color in the various tracts as the feathers continue to become un-

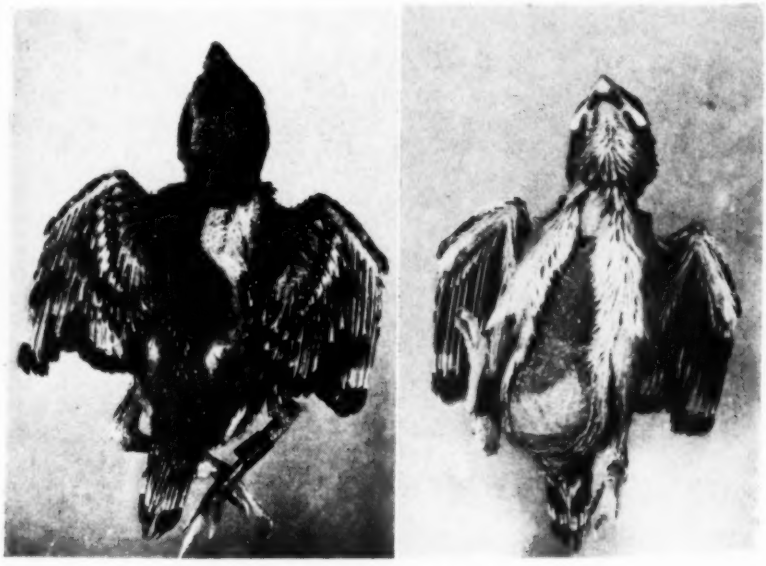

Figure 2. English Sparrow, ten days old.

sheathed. The lesser coverts are tan and form a slight wing bar. The head is becoming brown, although remaining dark gray about the base of the culmen. The back is brown but the neck remains dark gray, almost black. The rectrices have brown tips, the upper tail coverts are light brown, the lower tail coverts white. The alula and primaries appear slate gray. The humeral tract is rich brown in color, while the upper feathers in the femoral tract are tan and the lower ones white. The feathers on the front side of the leg in the crural tract are white while those on the back are tan. The ventral tract is light gray to white.

Tenth to Fifteenth Day

Most birds which are handled daily for nine days will leave the

nest prematurely. Measurements were made on a limited number of banded birds retrieved after they had left the nest.

In these five days the feathers rapidly cover the apteria, giving the young birds a more adult appearance. The coverts on the wings and tail lose their sheaths more rapidly, accentuated to some extent by the use of the bill. The basal sheaths of the flight feathers are retained for some time after the young depart from the nest. A few sheaths are visible in parts of the spinal tract when the bird leaves the nest but none are evident in the ventral tract, except possibly in the cervical region.

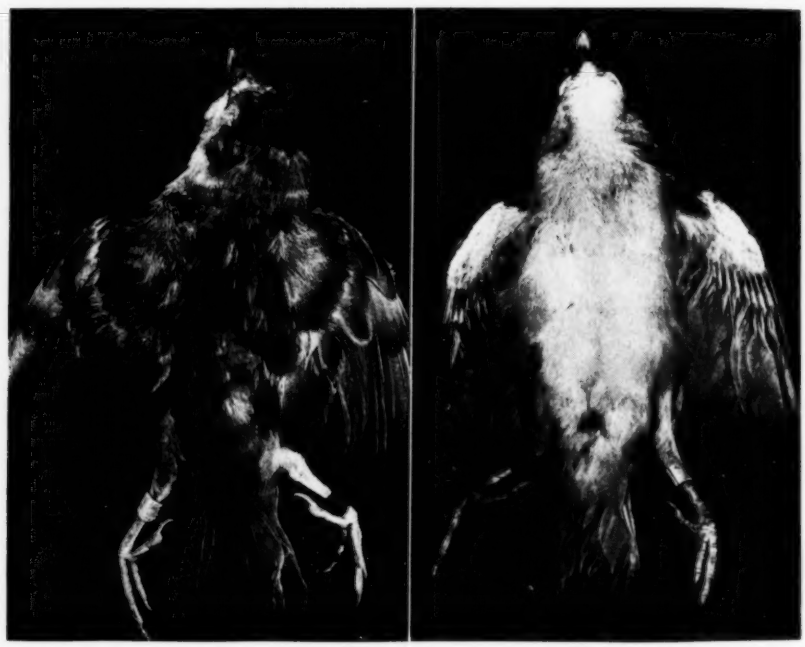

Figure 3. English Sparrow 14 days old.

The primaries grow from 20 millimeters on the tenth day to 44.6 millimeters on the fifteenth day and the sheaths on these feathers are reduced from four-fifths to one-fourth the total length. The rectrices advance from 11 to 30.7 millimeters in the same period and have become unsheathed from 3.6 to 21.7 millimeters.

The bill has a horn-colored tip, now surrounded by a black ring half way back. The soft portion of the bill has been reduced to about one-third of the horny central portion. The toe-nails are much darker than when hatched. The interior of the mouth has become pinkish-yellow. Young males will show signs of a black bib. In other respects the young birds look much like adult females.

Sixteenth to Eighteenth Day

Only a few birds were available for observation in this period as most of those observed earlier had left the nests. The most noticeable change is in the rapid rate of growth of the flight feathers. The primaries advance from 43 to 52 millimeters and the rectrices from 30.7 to 40 millimeters. The primary and tail coverts have reached maturity. The birds are very active and can fly rather well.

Comparison with Other Species

The development of the feather tracts, the pattern and centers of development, and the appearance of the individual feathers in the English Sparrow, follow very closely that found by Boulton (1927) for the House Wren, another hole-nesting species. However, when compared with the Tree Sparrow, studied by Baumgartner (1938), the Chipping Sparrow which I studied (1937), and the Song Sparrow studied by Nice (1937), there is a marked difference, which is expressed particularly by the early development of the contour feathers in these non-hole-nesting species. These birds progress more rapidly in their earlier stages, but the English Sparrow feathers out very rapidly in the later stages. Since it remains in the nest four to five days longer it is also more fully feathered when it leaves the nest, than are these other species.

Fledging Period

The time required for fledging varied from 12 to 16 days in 23 nests which were not used for measuring the young. In the nests where the young were handled daily the young left sooner than that. The average fledging period was 14.4 days in the 23 more or less undisturbed nests. The young left the nest at 12 days in five nests, at 13 days in seven nests, at 14 days in four nests, at 15 days in six nests, and at 16 days in one nest.

Witherby et al. (1938) give the fledging period in England as 15 days, but the Heinroths (1924) and Niethammer (1937) say that the young birds normally remain in the nest for 17 days in Germany.

Average Rate of Growth

Many birds of known ages were measured on each day of the fledging period. The average for all measurements and the number of birds used daily, are shown in Table 1. Although some are shown in fractions on the chart, it indicates merely the result of averaging the measurements of a number of birds. Weight increased about two grams per day for the first thirteen days, starting at 2.8 grams and reaching 25.6 grams, the greatest weight attained before leaving the nest.

Behavior of Adults During the Fledging Period

From the time the young birds hatch until they leave the nest both

TABLE 1

AVERAGE RATE OF GROWTH OF ENGLISH SPARROWS

Day	Number of measurements	Total length	Wing	Gape	Primaries	Primary coverts	Rectrices	Weight
1	53	40.0	6.1	7.5				2.8
2	39	48.6	7	9				4.8
3	33	56.1	9.2	10				6.9
4	30	63.8	12.5	11.8	pt.			10.2
5	23	67.6	16.5	12.2	1.4(pt.)*	.6 (0)	1.9(pt.)	11.7
6	31	73.0	17.9	12.8	3.3(pt.)	1.7 (0)	2.7 (1.0)	13.8
7	21	82.5	22.7	13.2	6.6 (1.0)	4 (0)	5.3 (1.5)	16.4
8	25	84.6	27.3	13.8	11.7 (2.0)	7 (1.4)	8 (2.0)	18.0
9	19	91.0	32.7	13.8	18.8 (4.3)	9.8 (1.8)	11 (2.0)	20.3
10	20	91.0	34.1	14	20.1 (4.5)	10.8 (3.0)	11 (3.6)	20.4
11	19	103.0	41.4	14.4	27.7(11.0)	15.2 (7.4)	17.8 (6.6)	22.7
12	10	107.2	45.8	14.4	29.9(16.7)	17.1(11.8)	21.2(10.2)	22.7
13	15	115.0	49	14.7	36 (25.0)	18 (13.6)	25 (15.0)	25.6
14	6	117.0	50	14.8	37.5(25.5)	18.1(14.8)	27.4(16.5)	25.2
15	4	123.0	57	14.8	43.6(32.1)	18.8(15.0)	30.7(21.7)	23.9
16	1	112.0	42	14.5	40 (25.0)	22 (14.0)	25 (22.0)	26.0
17	2	126.0	60	15	49 (43.0)	18 (18.0)	33 (31.5)	22.5
18	1	126.0	64	16	52 (45.0)	18 (18.0)	40 (30.0)	

Measurements are in millimeters and grams.

* "Pt." is used to indicate a mere point of feather—too small to measure readily. The second figures, in parentheses, indicate the amount of the same feather that had broken out of the sheath.

parents share equally the duty of feeding them. However, other duties are not shared equally. The female takes care of the nest sanitation and keeps the young warm at night. If there is overcrowding in the nest, the excrement may not be removed. Although I did not find any males spending any time in the nest box, Daanje (1941) in Holland reports that the male does share equally with the female in the brooding of the young. During the first five days after hatching the young are fed by regurgitation, but are not fed in this manner during the latter part of the period in the nest, as was pointed out earlier by Niethammer (1937) and Witherby et al. (1938).

SURVIVAL

From 180 eggs laid in 38 nests, 127 young were raised successfully, which is 70.5 per cent success. This corresponds very closely with that found for other hole-nesting species and is contrasted with 43 per cent success for species nesting in the open (Nice 1937: 142–144). In none of the 38 nests did six young survive, but in 7 five survived, in 12 four survived, in 11 three survived, in one nest two survived, and in two nests none survived.

Young Leaving the Nest

As the young develop and the time for them to leave the nest approaches, the larger ones are found to be the highest in the nest, with their heads sticking out the entrance. Thus, they have a distinct advantage during the latter part of the fledging period as all of the feeding is done from the outside of the nest cavity.

One young was observed to leave the nest under fairly normal circumstances. It was sitting in the entrance, while both of the adults were away. A door slammed nearby and the young flew out, landing on a shed roof close to the nest. It attempted to fly up the side of the barn when a person approached, but failed and stopped on a window sill, half way down the side. When the female returned, she found it there and coaxed it to a lower level and thence over the shed out of sight. The female and young were not seen again that day and the male continued to feed the young in the nest alone.

In several cases the young flew from the nest when I approached. The older ones commanding the highest position in the nest were always the first to leave. Two days often elapsed before the others were ready for their initial flight.

The young are able to fly rather well upon leaving the nest. One young bird was seen to leave a nest box about eight feet from the ground and to fly sixty yards, landing in the top of a tall elm tree. It was almost impossible to catch any young sparrows which left the nest around fifteen days after hatching. The longer period in the nests permits the English Sparrows to acquire more strength and better developed feathers than such birds as Robins, Chipping Sparrows, or Tree Sparrows.

Young Birds Out of the Nest

In the instance in which the young bird was observed to leave the nest because of the door slamming, the female soon found it and then remained with it, while the male cared for the rest of the family. At other times when the young left, both the male and female were observed feeding the same young. However, the more common procedure was for the female to care for several of the young and the male to care for the others. This seemed to be determined mostly by the manner of scattering as the young tried to follow the adults to secure food.

Contrary to Daanje's (1941) statement that the female takes most of the care of the fledged young (for the male may be more interested in starting the next brood than in the older young), I observed a fairly equal distribution of care during the period directly after the young left the nest. In one case the female withdrew within one week, starting a new nest while the banded male continued to feed the young for at least two weeks more.

Niethammer (1937) also observed this attention by the male, and

says that the young "are fed for a while after learning to fly, evidently especially by the male, then collect in flocks, which the older birds join later. At this time true mass gatherings often take place, accompanied by a great deal of noise, in densely foliaged tree tops, also in the middle of large cities."

The Heinroths (1924) observed that "the young have a strong bond to one another after leaving the nest, in contrast to thrushes, nightingales, and some other birds that prefer to be alone."

The adults feed the young for at least two weeks and may do so for a longer period. Since the English Sparrow raises two broods each year and the second brood may not be started for a month or more after the first was started, juveniles can be found in all stages of development during the latter part of the summer.

A complete post-juvenal molt begins four to six weeks after the birds take to the wing, the Heinroths (1924) setting it at five weeks. The general molting for all young took place at Ithaca during the early part of August and continued through mid-September, requiring four to five weeks to complete the molt.

Summary

English Sparrows are hatched without natal down.

The interior of the mouth of newly hatched young is bright red, but becomes pinkish-yellow before the young leave the nest.

The egg tooth disappears and the edges of the bill change from white to lemon-yellow by the fourth day after hatching.

The first appearance of the feathers and the sequence of their development in the various tracts and regions follows a very definite order which resembles very closely that found by Boulton in House Wrens and Weaver in Chipping Sparrows.

The greatest development in the plumage of young sparrows is delayed until the latter part of the period in the nest. The greatest change in appearance of young English Sparrows occurs between the age of six and seven days, when most of the feathers emerge and many of them lose their sheaths.

By the tenth day after hatching the color pattern is evident, showing a wing bar, and in some males a black bib.

Practically all of the sheaths have disappeared from the contour feathers and all but one-fourth of the flight feathers are unsheathed by the fifteenth day. These sheaths may remain one to two weeks after the young depart from the nest. The greatest amount of sheath is present in the flight feathers on the eleventh day. The amount of sheathing present gives an accurate criterion of the age of young birds in the nest.

Most of the young left the nest at about the fifteenth day, but English Sparrows may remain in the nest for seventeen days if entirely undisturbed.

Males and females share about equally in the feeding of the young at the nest, but the females do the greater portion of the nest sanitation. Both birds may brood the young, although the female does the greater part of it and always stays in the nest during the night. The young are fed by regurgitation during the first part of the period after hatching.

There was 70.5 per cent success of survival in thirty-eight nests which produced 127 young from 180 eggs laid. This corresponds closely to that reported for other hole-nesting species.

The older young are able to command the most advantageous positions in the nest and thus receive relatively more food and often are able to leave the nest several days before the other young. The young can fly rather well upon leaving the nest, considerably better than do the young of most species that nest in the open.

The young are fed by the adults for a period of two weeks, and probably more, after leaving the nest. The young have a strong bond for one another. The young, out of the nest, may be fed entirely by one adult or by both.

A complete post-juvenal molt begins about five weeks after the young leave the nest. It began in early August and ended in mid-September at Ithaca in 1937.

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FACTORS INFLUENCING LOCAL MOVEMENTS OF WOODLAND BIRDS IN WINTER *

BY VERNA R. JOHNSTON

DURING the winter of 1939–40 and 1940–41, I studied the local movements of birds in a forested area along the Sangamon River near Cerro Gordo, Illinois, 40 miles southwest of Champaign.

A map of the area was drawn and copies of it were mimeographed to be taken into the field. The map was drawn roughly to scale and contained various small landmarks by which a bird's location at any

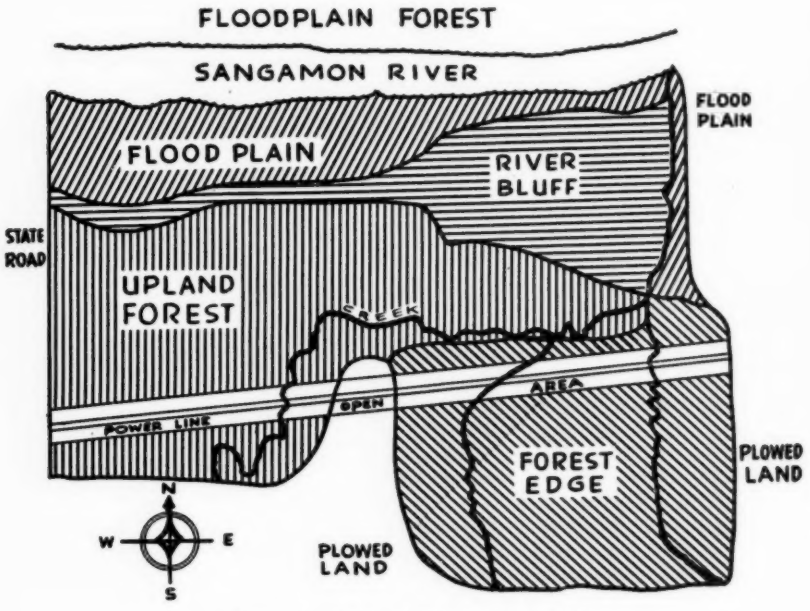

Figure 1. Map of the area studied.

place in the area could be determined. On each trip the distribution of the birds in the area was carefully marked on a copy of the map, and notes were taken of the birds' behavior, flocking, songs, and other points. Trips to the area were made one to two times per week during the winter months.

* Contribution from the Zoological Laboratory of the University of Illinois. Grateful acknowledgment is made to Dr. S. Charles Kendeigh for his suggestions and guidance.

I watched particularly the effects of wind, temperature, sun, and precipitation on the distribution of the birds, and on the tendencies of certain species to flock together.

Description of the Area

The area is a second-growth forest, typical of those used by farmers for timber and grazing over much of Illinois. It is composed of 46 acres of four chief habitat types (Figure 1): (1) a floodplain along the Sangamon River (2) a heavily-wooded bluff above the floodplain (3) an upland open forest and (4) a forest-edge. An electric powerline runs diagonally through the upland forest and forest-edge area, leaving an open space of twenty yards width in which the trees have been cut and in which common mullein (*Verbascum thapsus*), coralberry (*Symphoricarpos orbiculatus*), thistle (*Cirsium* sp.), and other sun-loving plants grow. The river bluff, 50 feet high, acts as a windbreak, furnishing protection on its south side from north winds and, likewise, shelter on the low north-exposed floodplain from south winds. The bluff slopes steeply to the floodplain on the north but very gradually to the creek bottom on the south. In the forest-edge area elevation is low along the creeks and higher between them. A brief description of the chief vegetation found in each of the four habitats is here included.

Floodplain:

The dominant trees in the low, wet floodplain are silver maple (*Acer saccharinum*), American elm (*Ulmus americana*), and sycamore (*Platanus occidentalis*). Poison ivy (*Rhus Toxicodendron*) is very abundant, and elderberry (*Sambucus canadensis*), wood nettle (*Laportea canadensis*), and giant ragweed (*Ambrosia trifida*) form dense stands during the summer. This area is ungrazed and is flooded each spring. It is but one part of a floodplain extending down both sides of the Sangamon River.

River Bluff:

The river bluff is fairly moist and is characterized by tall red oak (*Quercus borealis*), sugar maple (*Acer saccharum*), and ironwood (*Ostrya virginiana*), with slippery elm (*Ulmus fulva*) and hackberry (*Celtis occidentalis*) also quite abundant. This is the most heavily-wooded habitat, ungrazed, and the region in which spring flowers are most common. A strong north wind strikes the bluff ridge with tremendous force.

Upland Forest:

The upland forest covers a larger portion of the total area than any other one habitat, is open and dry, is grazed freely, and consists almost entirely of mature white oaks (*Quercus alba*) and shagbark hickories (*Carya ovata*), most of them over forty feet high. Coralberry is profusely scattered over this open forest, forming the chief undergrowth.

Forest-edge:

The forest-edge is a block of the type of vegetation usually found growing as a strip along the edge of a forest. The dominant plants here are hawthorn (*Crataegus* sp.) and hazelnut (*Corylus americana*), with black raspberry (*Rubus occidentalis*), gooseberry (*Ribes gracile*), and osage orange (*Toxylon pomiferum*) well represented. This region contains few trees over thirty feet high, and includes the only dense shrub undergrowth found in the entire area. The forest-edge is surrounded on three sides by plowed fields and is connected with the open forest and floodplain on the fourth side. It is grazed and inhabited by numerous cottontail rabbits.

Winter Population

The winter bird population varied but slightly in composition during the two years, consisting of ten species in 1939–40 and eleven species in 1940–41. The average number of each species present one or both years is listed in Table 1. The larger population for 1940–41 is accounted for chiefly by a flock of Purple Finches which wintered in the area the second year, and by a larger number of Tree Sparrows. During the first winter the Tree Sparrows were usually found along a roadside hedge outside, but this hedge was cut the second year and they moved inside the study area. The absence of Red-headed Woodpeckers and the smaller number of Blue Jays in 1941 may have been caused by the poor acorn crop that year.

The data show 1.1 birds per acre in the winter of 1939–40, and 1.7 birds per acre in 1940–41 (an average of 1.4 birds per acre for two winters). The same birds did not stay in the area all the time. Likewise, some birds recorded on each trip doubtless wandered in from an adjacent territory. It is probable that the population counted in the area during the majority of the winter trips was representative of the actual population. Forbes and Gross (1923) gave a figure of .7 birds per acre in central Illinois in the winter of 1906–7, referring chiefly to open country and not to forests.

TABLE 1
Winter Bird Population

	1939–40	1940–41
Red-bellied Woodpecker (*Centurus carolinus*)	4	2
Red-headed Woodpecker (*Melanerpes erythrocephalus*)	3	0
Hairy Woodpecker (*Dryobates villosus*)	0	1
Downy Woodpecker (*Dryobates pubescens*)	4	5
Blue Jay (*Cyanocitta cristata*)	10	4
Black-capped Chickadee (*Penthestes atricapillus*)	6	7
Tufted Titmouse (*Baeolophus bicolor*)	6	8
White-breasted Nuthatch (*Sitta carolinensis*)	2	3
Cardinal (*Richmondena cardinalis*)	4	8
Purple Finch (*Carpodacus purpureus*)	0	15
Slate-colored Junco (*Junco hyemalis*)	8	12
Tree Sparrow (*Spizella arborea*)	3	12
	50	77

The numbers making up the winter population were arrived at by listing under each date the number of birds of each species counted on that date. Then, going over the numbers listed for all the trips during the winter months, the number which occurred most frequently was taken as the probable population of that species.

Wind

The effect of wind on the local movements of the birds in this area was very striking. It is unfortunate that, because wind was considered a minor aspect of the study when it began, an anemometer was not used, and records of the velocity of the wind were based on my own impressions. The velocities used are as follows: strong means a violent wind; slight means a mild breeze. The contrasting effects of only extreme velocities will be illustrated.

The effect of the wind on distribution is illustrated clearly in Figure 2. The birds included in this figure are winter residents and early spring migrants. The strongest winds and most marked effects on bird distribution occurred in March after the first migrants had appeared. Therefore these maps may be considered as recording distribution in late winter or very early spring. The two diagrams on the left in Figure 2 show the contrasting distribution of the birds on days with slight and with strong winds blowing from the northwest. The slight northwest wind had little effect on the birds, as they were spread all over the area. A strong northwest wind seemed to have caused the species to stay in the sheltered parts away from the blasts, as nearly all of them were on the east side and behind the protecting bluff.

The two diagrams on the right in Figure 2 present a most interesting point. These two maps were made on two consecutive days, March 15 and March 16, 1941. On March 15, a very strong wind was blowing from the south, and every bird in the woodland with the exception of one lone Blue Jay was found on the low, north-exposed floodplain, sheltered from the wind by the high river bluff. The following day the wind did a complete reverse and blew with tremendous force from the north. The floodplain, so well-populated the previous day, was this day deserted, and all the birds were found along the creek bottoms at the base of the south side of the bluff, well sheltered from the north wind's blasts.

The conclusion apparent from a study of these figures is that a slight wind has little or no effect on the distribution of birds in this forest, but a strong wind appears definitely to influence their movements. During this research, I made 39 maps of the distribution of birds during winter days, and they support fully the conclusion here drawn. Carpenter (1935) found that "the 'lee' side with reference to prevailing winds had by far the greatest bird population in all seasons observed," but he did not demonstrate day by day shifts with the changing direction of a strong wind.

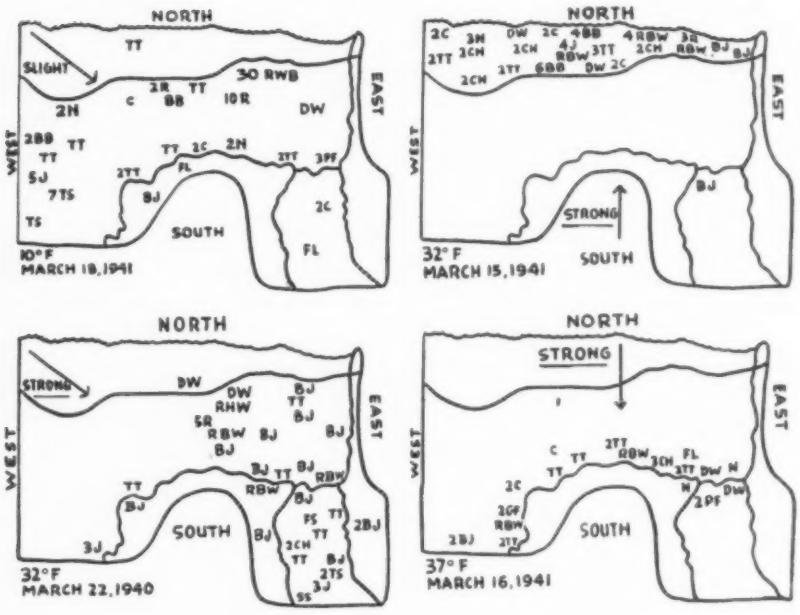

Figure 2. Maps illustrating the comparative effects of slight winds and strong winds on bird distribution. The arrows indicate wind direction.

Symbols:

FL—Flicker	BB—Bluebird
RBW—Red-bellied Woodpecker	RWB—Eastern Red-wing
RHW—Red-headed Woodpecker	C—Cardinal
DW—Downy Woodpecker	PF—Purple Finch
BJ—Blue Jay	GF—Goldfinch
CH—Black-capped Chickadee	J—Junco
TT—Tufted Titmouse	TS—Tree Sparrow
N—White-breasted Nuthatch	FS—Field Sparrow
R—Robin	SS—Song Sparrow

Temperature

The second factor which had an effect on both the activity and the distribution of birds in winter was temperature. Practically without exception, on days when the thermometer registered 25° F. or lower, all birds observed spent their entire time in feeding or hunting for food. When the temperature rose well above 25°, much time was still devoted to feeding, but some was now spent in preening and singing. This was generally true of each species, but especially of Titmice, Chickadees, Nuthatches, and Cardinals.

As an illustration of the effect of temperature on activity, I mention data for January 12, 1941. Cold weather had been constant just before this date, but on the twelfth the temperature was 29° at 7 A.M. and rose

to 58° by twelve noon. Titmice were observed chasing each other; they were scattered over the entire area in two's and three's, and were singing *peto-peto-peto* constantly. Chickadees moved over the area, singing *phoe-be* and answering each other; and a White-breasted Nuthatch was observed flashing the white in its tail feathers. On this warm, sunshiny morning in midwinter, the temperature rose to a spring level, and many of the birds reacted accordingly with spring behavior. A week later, on January 19, the temperature had gone down below 23° and the Titmice, Nuthatches, and Chickadees resumed their winter behavior, feeding constantly and singing little. What else but temperature could have caused such a decided change in activity in midwinter?

The effect of temperature on the social behavior of Titmice, Nuthatches, Chickadees, and Downy Woodpeckers proved interesting. In cold weather, 25° or below, these species tended to flock together and feed in groups. In warmer weather, above 25°, they tended to spread out and scatter over the area. My notes on flocking agree with the conclusion of Wilbur Butts (1931) that "the association of chickadees, nuthatches, and woodpeckers is only a temporary one." None of the many flocks which I watched stayed together for more than an hour. The average number of birds in a flock was ten or eleven, and an average flock consisted of five Titmice, three Chickadees, one Nuthatch, and one Downy Woodpecker. The birds had a tendency to flock early in the morning when the temperature was low and to spread out as the day grew warmer. This leads to the suggestion that flocking may be subject to daily rhythm, varying with the temperature, but this needs confirmation.

In addition, temperature had an apparent influence on the phyto-vertical occurrence of certain species. To secure food in cold weather, Titmice, Chickadees, Blue Jays, and Cardinals came down to the ground much more frequently than they did in spring, summer, and autumn. This is probably only partially a result of temperature.

Sun and Precipitation

Sun and precipitation are often considered important factors in the winter activity of birds. During the thirty-nine days of my study, the birds seemed to be equally active on sunshiny days and on cloudy days, with or without precipitation.

Summary

A second-growth forest along the Sangamon River in central Illinois consisted of forty-six acres of four chief habitats—(A) a low moist floodplain (B) a high river bluff (C) an open upland forest and (D) a forest-edge.

Trips were made to this area once or twice per week during the winters of 1939–40 and 1940–41. On each trip the distribution of the birds was carefully mapped and notes were taken on their activities.

The average winter population during the two winters was 1.4 birds per acre, and included ten and eleven species respectively.

A strong wind caused birds to seek sheltered areas and changes in the direction of the wind brought about day-by-day movements from one part of the area to another. A slight wind had little or no effect.

Low temperature caused birds to feed almost constantly and to sing little, whereas a rise in temperature decreased feeding and increased singing.

Black-capped Chickadees, Tufted Titmice, Downy Woodpeckers, and White-breasted Nuthatches showed a tendency to form flocks at temperatures below 25° and to scatter when the temperature rose above 25°.

As far as could be determined, sun and precipitation had no effect on the winter activity of birds in this study.

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NOTES ON BIRDS OF THE MONTERREY DISTRICT OF NUEVO LEON, MEXICO

BY GEORGE MIKSCH SUTTON, OLIN SEWELL PETTINGILL, JR., AND ROBERT B. LEA

THE Cornell University-Carleton College Expedition visited the Monterrey district of Nuevo Leon on February 25–27 and May 5–9, 1941. In February we worked the flat country north of the city (at about 1,500 feet elevation). In May, activities centered on the Mesa de Chipinque (elevation about 5,000 feet), though a brief trip to the village of Santa Rosa, 12 miles northeast of Monterrey, was made on May 9. The following list includes all species actually collected about Monterrey, as well as two taken near Canoas, a village just north of Montemorelos.

We are grateful to John W. Aldrich for his courtesy in lending series of *Atlapetes pileatus* (including the type of *A. p. dilutus*) and *Toxostoma longirostre;* to Josselyn Van Tyne, for lending a series of *Caprimulgus vociferus arizonae* and for comparing three *Pipilo maculatus* specimens with the type of *P. m. gaigei;* and to Lloyd Hulbert, a graduate student at Cornell University, for his excellent photograph of the series of *Accipiter striatus.*

Elanus leucurus (Vieillot). White-tailed Kite. A single bird was seen several times flying over the flat country north of Monterrey, February 26 and 27.

Accipiter striatus suttoni van Rossem. Mexican Sharp-shinned Hawk. A breeding male and female, taken at the Mesa de Chipinque May 5–6, exhibit clearly the faintly barred underparts and solidly brown flags of this race. In both specimens the eyes were dark reddish-brown. The female had a well defined brood-patch. The accompanying photograph shows the type and three topotypes of *suttoni,* with an average male and female *velox* from the eastern United States.

Otus asio (Linnaeus). Screech Owl. Three Screech Owls were taken: two females, in Anahuac Park, two miles north of Monterrey, February 25 and 26; and a male at the Mesa de Chipinque, May 5.

Cornell University now has three topotypical *O. a. semplei.* The type (at Carnegie Museum) is a gray-phase bird like two of these topotypes, but the race is definitely dichromatic, a male taken by Mr. Semple on March 18, 1939 (see Sutton and Burleigh, 1941: 159) being a very red bird with the usual distinctive feather-patterns of that color-phase. The 1941 male measures: wing, 159; tail, 79.

The two above-mentioned Monterrey females are puzzlingly intermediate in color-phase. Both are strongly reddish throughout, but the feather-patterning is that of gray-phase birds. They measure: wing, 158, 160; tail, 81, 79. Strictly comparable material must be obtained before we can be sure what Screech Owl occurs at Monterrey. Sutton has long believed *semplei* to be a montane race, and *mccallii* to be the Monterrey bird, but this concept may be wrong.

Bubo virginianus pallescens Stone. Western Horned Owl. A faded female taken in Anahuac Park, 2 miles north of Monterrey, February 26, has buffy white, immaculate toes and lower tarsi. Its small size (wing, 344 mm.) indicates some approach to *mayensis* (see Griscom, 1935: 547). A very small male Horned Owl (wing, 315) taken near Linares, 80 miles south of Monterrey, has been identified as *mayensis* (Sutton and Burleigh, 1941: 159).

Caprimulgus vociferus setosus van Rossem. Mexican Whip-poor-will. Four breeding specimens (3 males, 1 female) were taken at the Mesa de Chipinque, May 5. In identifying these birds, three *C. v. setosus* (a male topotype, from Galindo, Tamaulipas; a female from Realito, Tamaulipas; and a breeding male from Las Vigas, Veracruz), and a series of *C. v. arizonae* (four virtual topotypes and ten birds from the Chisos Mountains, Brewster County, Texas) were used for comparison. In darkness and dullness throughout, our Mesa de Chipinque birds agree with the three *setosus*, thus extending the known range of this form eastward from "southern Coahuila" (Oberholser, 1914: 12, footnote) and northward from central Tamaulipas (Peters, 1940: 199) to include mountainous parts of western Nuevo Leon. The Chisos Mountains birds vary considerably and as a lot appear to be intermediate between *arizonae* and *setosus*, the females tending to look like the former, some of the males like the latter.

The detailed diagnosis of the Mexican Whip-poor-will (at that time known as *macromystax*) in Brewster's original description of *C. v. arizonae* caused us considerable confusion until we examined a specimen of *Caprimulgus serico-caudatis salvini* to find that, point for point, the bird Brewster believed to be the Mexican Whip-poor-will and was using for comparison was in fact this superficially similar but actually quite distinct species.

Chloronerpes aeruginosus (Malherbe). Mexican Green Woodpecker. Seen repeatedly on the Mesa de Chipinque. Two occupied nests found (at about 5,000 feet and 5,500 feet) and a male with much enlarged testes and well-defined brood-patch taken on May 7.

Nuttallornis borealis (Swainson). Olive-sided Flycatcher. Noted but once, May 7, when a female was taken at about 6,000 feet on the Mesa de Chipinque.

Empidonax difficilis Baird. Western Flycatcher. Male, with much enlarged testes, taken May 8 at about 7,000 feet on the Mesa de Chipinque. The Western Flycatcher of the Mesa has been identified as *E. d. hellmayri* (Sutton and Burleigh, 1941: 159). But after comparing the four available specimens with seasonally comparable, topotypical *hellmayri*, we are convinced that they are brighter throughout than that form, greener above, yellower on the belly, more brownish olive on the chest—and that they represent one of the links in the chain of races (*immemoratus, occidentalis, salvini, dwighti*, etc.) connecting the dull *hellmayri* with the bright *flavescens* of Costa Rica. We consider it inadvisable, however, to bestow a separate name on them at this writing, since they probably are very close to one of the above-named races. They measure: wing, 70.5, 71.5, 70, 72 mm.; tail, 62.5, 63, 60, 64 (average, wing, 71, tail, 62.3).

Troglodytes brunneicollis cahooni Brewster. Cahoon's Brown-throated Wren. Noted infrequently on the Mesa de Chipinque at from 5,500 to 7,000 feet. Nest with half-grown young found in hole in cliff along trail leading to top of mountain (at about 6,000 feet), May 8.

Thryothorus ludovicianus berlandieri Baird. Berlandier's Wren. Noted repeatedly at Monterrey and on the Mesa de Chipinque. Female taken along the main highway near the village of Canoas, just north of Montemorelos, February 27.

Toxostoma longirostre sennetti (Ridgway). Sennett's Long-billed Thrasher. We have compared a male specimen taken two miles north of Monterrey, February 26, with a series of nine January and February *T. l. longirostre* from Puebla, Veracruz, San Luis Potosi, and the State of Mexico. Our specimen is noticeably grayer above than any of these though not strikingly whiter below. Its measurements (wing, 96; tail, 126.5; exposed culmen, 27) indicate *sennetti*.

Vireo griseus griseus (Boddaert). Northern White-eyed Vireo. Male (wing, 61 mm.; tail, 53.1) taken 2 miles north of Monterrey, February 26. Though the testes of this bird were noticeably enlarged (3 x 4 mm.) we did not hear it singing, so it probably was a transient on its way northward. The breeding race of the Monterrey district is said to be *V. g. micrus* (see Hellmayr, 1935: 114).

Polioptila caerulea amoenissima Grinnell. Western Blue-Grey Gnatcatcher. Gnatcatchers were seen repeatedly in the brush country north of Monterrey. The only specimen taken (female?, February 26) has the grayish throat and breast and dark upper parts that characterize this race. The wing measures 50 mm., the tail, 55.

Vermivora celata celata (Say). Eastern Orange-crowned Warbler. Noted several times at Anahuac Park, north of Monterrey, where a female (molting on throat) was taken February 26.

Richmondena cardinalis canicauda (Chapman). Gray-tailed Cardinal. A male (wing, 89 mm., tail, 97) taken 2 miles north of Monterrey, February 27, is a bright, well plumaged example of this race. The testes were only slightly enlarged.

Cyanocompsa parellina (Bonaparte). Blue Bunting. Two females, taken along the main highway near Canoas, February 27, are obviously smaller-billed and paler than *C. p. parellina* from central Veracruz, but whether they are *C. p. beneplacita* or *C. p. lucida* we cannot say, for we have thus far been unable to find any character by which females of these two races can be distinguished.

Passerina versicolor versicolor (Bonaparte). Varied Bunting. Recorded with certainty but once, when an adult male was taken 9 miles north of Monterrey along the road to Santa Rosa, May 9.

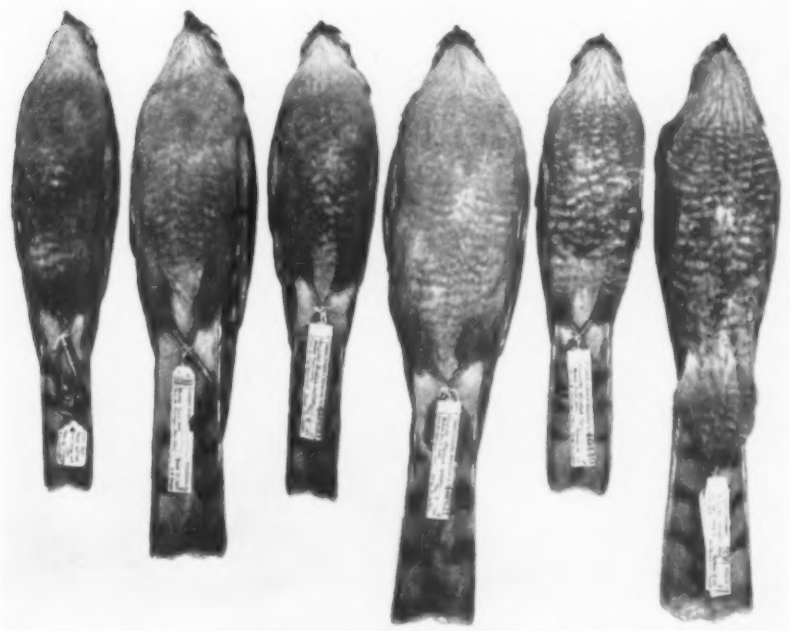

Figure 1. Adult Sharp-shinned Hawks. The four at the left are *Accipiter striatus suttoni* (type at extreme left) from the Mesa de Chipinque, Nuevo Leon. The two at the right are average *A. s. velox*. The females are instantly distinguishable because of their large size.

Atlapetes pileatus dilutus Ridgway. Chihuahua Rufous-capped Sparrow. Several specimens of this finch were taken by the first Semple Expedition at the Mesa

de Chipinque February 9–14, 1938. On comparison with the type of *A. p. dilutus*, these were thought to be too yellow below and not gray enough above for that race, hence were reported as *A. p. pileatus* (Sutton and Burleigh, 1939: 45). The following year, on April 8, two more specimens were obtained near Jacala, Hidalgo. These were much yellower below than the Mesa birds, in spite of the fact that they had been subjected to several weeks more wear and exposure.

Interested in determining to what extent color of underparts might vary seasonally, Sutton collected a breeding pair of Mesa birds on May 7, 1941. These proved to be very pale below, much paler than the palest February specimen taken in 1938. Were these pale birds *dilutus?*

The U. S. Fish and Wildlife Service courteously lent us their entire series of 15 *Atlapetes pileatus*, including the type of *dilutus*. Examining these, together with the seven adult Nuevo Leon and Hidalgo specimens at present in the Cornell collection, we find (1) that Nuevo Leon birds and the type of *dilutus* are definitely the palest and dullest below of the lot; (2) that by far the most richly colored individual of the whole series is a *female* taken February 10, 1893, at Tetela del Volcan, Morelos; and (3) that birds from more southerly latitudes of Mexico (Veracruz, Jalisco, Puebla, Guerrero, and Michoacan) all tend to be bright yellow below and brown-backed in comparison with the Mesa de Chipinque series, the one Hidalgo bird referred to above being about halfway between the very pale and very bright extremes.

Our study convinces us that the type of *A. p. dilutus* (April) was a faded bird. Collected in 1884, it probably has faded still more with the passing of the years. We nevertheless believe *dilutus* to be valid, and offer the pale-bellied, though freshly plumaged, Mesa de Chipinque birds as evidence. The six specimens measure: males, wing, 61-67 mm. (av. 64.5); tail 63–70 mm. (av. 67); females, wing, 59.5, 60.5; tail 59, 61.

Two young birds just out of the nest were also collected at the Mesa on May 7, 1941. These are obscurely colored—dull brown above; somewhat yellow on the throat; light buffy, washed with yellow, on the belly.

Arremonops rufivirgatus rufivirgatus (Lawrence). Texas Sparrow. Noted repeatedly about Monterrey and on the Mesa. A female taken in Anahuac Park, north of Monterrey, February 26, is darker chested than topotypical specimens from Brownsville, Texas, in this respect showing some approach to *A. r. ridgwayi*. A juvenal female (tail, 40 mm.) taken on the Mesa, May 6, was being fed by its parents.

Pipilo maculatus gaigei Van Tyne and Sutton. Gaige's Spotted Towhee. Three breeding males taken at the Mesa de Chipinque, May 8, have been directly compared with the type of *gaigei* and are considered by Van Tyne to belong to that race. Two of these birds appear to be in their first breeding plumage.

Aimophila cassinii (Woodhouse). Cassin's Sparrow. Fairly common in plains country north of Monterrey, where a female was taken February 27.

Aimophila ruficeps boucardi (Sclater). Boucard's Sparrow. A breeding male (testes 5 x 7 mm.) collected May 8 in a dry gully below the Mesa de Chipinque (at about 4,000 feet), has the dark crown-patch and measurements (wing 62 mm.; tail, 65.5) of this race. That Nuevo Leon is not included by Hellmayr (1938: 530) in the range of *boucardi* is probably merely an oversight.

Amphispiza bilineata bilineata (Cassin). Black-throated Sparrow. Noted repeatedly in opener country north of Monterrey. On May 9 an adult male and two stub-tailed juvenals were collected. The smallness of the male (wing, 62.5 mm.; tail, 58.) and reduced white patch on the outermost rectrix (about 13 mm. long) indicate that this race, rather than *grisea*, is the breeding form of the region.

Spizella pallida (Swainson). Clay-colored Sparrow. Noted repeatedly in opener country about Monterrey in February, but not in May. Female taken February 26.

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FREQUENCY OF OCCURRENCE OF SUMMER BIRDS AT THE UNIVERSITY OF MICHIGAN BIOLOGICAL STATION [1]

BY KATHERINE A. WHITE [2]

THE need of an accurate and uniform method of expressing the results of bird population studies has long been recognized. Quantities of data already available are of little value because of the inexactness and variation of method used by field investigators.

In making a study of the bird population in the vicinity of the University of Michigan Biological Station during the summer of 1941, I applied Raunkaier's Law of Frequence. This method of study is an adaptation of a system used by botanists in analyzing populations of plants.

Raunkaier, a Danish botanist, based his law on eleven different botanical investigations carried on by himself and others in Europe. Kenoyer (1927) states the law as follows: The percentage of frequence of a given species is the percentage ratio which the plots on which the species occurs bears to the whole number of plots taken. Kenoyer also explains its application as follows: using at least 25 plots, the number of species on each plot is counted. Then to determine frequence of the species on 25 plots, the number of plots on which any one species is found is divided by 25. If a species is found on each plot, the frequence is 25 divided by 25, or 100 per cent; if it is found on 5 plots, the frequence is 5 divided by 25, or 20 per cent. In making a number of such surveys, it was usually found that there were larger numbers of species of low frequence than of higher frequences. As one proceeds to the greater frequences, the number declines steadily until the highest (or next highest) frequence is reached, at which point it increases slightly. To express this in a formula, Raunkaier let A, B, C, D, and E represent frequences from 1–20 per cent, 21–40 per cent, 41–60 per cent, 61–80 per cent, and 81–100 per cent respectively. The distribution of the frequences could then be expressed:

$$A > B > C \gtrless D < E$$

Kenoyer was the first to suggest the use of Raunkaier's Law in making animal population studies, while Linsdale (1928, 1932, 1936; Linsdale and Rodgers, 1937) was the first to apply the law to bird life.

Linsdale (1932) points out several advantages in the use of Raunkaier's Law in studying bird populations:

[1] Contribution from the University of Michigan Biological Station.

[2] I wish to express my appreciation to Dr. Olin Sewall Pettingill, Jr. of Carleton College, Northfield, Minnesota, for numerous suggestions concerning the keeping of proper records, source material of similar studies, and especially for the reading and constructive criticism of the manuscript for publication. I am also grateful to Dr. Jean M. Linsdale of the Museum of Vertebrate Zoology, Berkeley, California, for several helpful suggestions and his explanation of a similar bird frequency study made in northern Michigan.

1. It gives a more nearly correct impression of the relative abundance of birds than any other method.
2. It makes it possible to analyze the composition of the bird population.
3. It makes it possible to compare the population of one locality with that of other localities and regions.
4. Over a period of time birds are likely to be observed on a certain area on the number of occasions which parallels their abundance.

Linsdale (1932) also points out several factors which decrease the reliableness of this method:

1. Nocturnal birds will be slighted, as will be small birds of retiring habits.
2. The numbers of birds observed will be affected by weather conditions.
3. Daily variations in the route and distribution of attention of the observer will also affect the birds recorded.

The 1941 Study at Douglas Lake

The University of Michigan Biological Station is located on South Fishtail Bay at the south end of Douglas Lake in Cheboygan County, Michigan. Douglas Lake lies about midway between Lake Michigan and Lake Huron and about thirty miles below the northern end of the Lower Peninsula. The territory covered by this study included four routes:

Route 1. The shore of the lake from the Station area to North Fishtail Bay (2½ miles).

Route 2. The woodland lying northeast from the Station to North Fishtail Bay (2 miles).

Route 3. State Street, the main street of the Station which is lined on either side by student and faculty cabins (½ mile).

Route 4. The hill immediately south of the Station (1½ miles).

The shore is barren of vegetation throughout most of the territory covered. It is bordered with white pines (*Pinus Strobus*) intermingled with a few aspens (*Populus grandidentata* and *P. tremuloides*) and red pines (*Pinus resinosa*). The woodland consists mainly of an aspen-birch association which gradually changes to an association of conifers as one progresses northward from the Station. The trees found there are aspens, red maple (*Acer rubrum*), white birch (*Betula alba* var. *papyrifera*), beech (*Fagus grandifolia*), white and red pine, red oak (*Quercus borealis*), and wild cherry (*Prunus* sp.). Also present are such shrubs as sumac (*Rhus typhina*), service berry (*Amelanchier canadensis*), and alder (*Alnus incana*). The conifer area consists mainly of white cedar (*Thuja occidentalis*), and balsam (*Abies balsamea*). The trees found around the camp and laboratories of the Station consist mainly of red

TABLE 1

FREQUENCY OF SPECIES OCCURRENCE AND NUMBERS OF INDIVIDUALS OBSERVED

The 80 species recorded	Number of days seen	Per cent of frequency	Total individuals	Rank in numbers	Rank in frequency
Black-capped Chickadee	30	100	666	2	A
Cedar Waxwing	30	100	567	3	A
Robin	30	100	512	4	A
Kingbird	30	100	399	7	A
Red-eyed Vireo	30	100	282	8	A
Spotted Sandpiper	30	100	264	10	A
Wood Pewee	29	96.7	124	12	A
Purple Martin	28	93.3	1271	1	A
Ring-billed Gull	27	90	477	5	A
Chipping Sparrow	27	90	212	11	A
Least Flycatcher	25	83.3	117	14	C
Black and White Warbler	25	83.3	87	18	C
Herring Gull	25	83.3	74	21	C
Blue Jay	24	80	276	9	C
Flicker	24	80	124	12	C
Oven-bird	24	80	109	15	C
Song Sparrow	23	76.7	77	19	C
Purple Finch	23	76.7	71	23	C
Caspian Tern	23	76.7	66	25	C
Baltimore Oriole	22	73.3	121	13	C
Nighthawk	22	73.3	103	16	C
Rose-breasted Grosbeak	21	70	75	20	C
Redstart	21	70	46	28	C
Goldfinch	20	66.7	70	24	C
Cowbird	20	66.7	53	26	C
Hairy Woodpecker	17	56.7	39	30	M
Mourning Dove	17	56.7	36	32	M
Bank Swallow	16	53.3	433	6	M
Downy Woodpecker	16	53.3	37	31	M
Common Tern	15	50	71	23	M
Brown Thrasher	15	50	49	27	M
Red-eyed Towhee	15	50	44	29	M
Crested Flycatcher	15	50	39	30	M
Black-billed Cuckoo	15	50	24	35	M
White-breasted Nuthatch	15	50	21	37	M
Ruffed Grouse	11	36.7	73	22	M
Crow	11	36.7	24	35	M
Scarlet Tanager	11	36.7	20	38	M
Black-throated Green Warbler	11	36.7	19	39	M
Kingfisher	11	36.7	15	42	M

White-breasted Nuthatch	15	50	21	37	M
Ruffed Grouse	11	36.7	73	22	M
Crow	11	36.7	74	35	M
Scarlet Tanager	11	36.7	20	38	M
Black-throated Green Warbler	11	36.7	19	39	M
Kingfisher	11	36.7	15	42	M
Killdeer	10	33.3	92	17	M
Rough-winged Swallow	9	30	27	34	U
Hermit Thrush	9	30	15	42	U
Vesper Sparrow	8	26.7	16	41	U
Yellow-billed Cuckoo	7	23.3	13	44	U
Phoebe	7	23.3	8	47	U
Northern Yellow-throat	6	20	9	46	U
Canada Warbler	6	20	9	46	U
Great Blue Heron	5	16.7	10	45	U
Catbird	5	16.7	5	49	U
American Merganser	4	13.3	34	33	U
Barn Swallow	4	13.3	23	36	U
Black Duck	4	13.3	14	43	U
Wood Thrush	4	13.3	8	47	U
Goshawk	4	13.3	6	48	U
Bald Eagle	4	13.3	4	50	U
Red-wing	3	10	18	40	U
Common Loon	3	10	4	50	U
Chestnut-sided Warbler	3	10	4	50	U
Least Sandpiper	3	10	3	51	U
Nashville Warbler	3	10	3	51	U
Blackburnian Warbler	3	10	3	51	U
Blue-winged Teal	2	6.7	13	44	R
Red-breasted Nuthatch	2	6.7	3	51	R
Sharp-shinned Hawk	2	6.7	2	52	R
Tree Swallow	2	6.7	2	52	R
Winter Wren	2	6.7	2	52	R
Solitary Sandpiper	1	3.3	2	52	R
Whip-poor-will	1	3.3	2	52	R
Slate-colored Junco	1	3.3	2	52	R
Red-breasted Merganser	1	3.3	1	53	R
Greater Yellow-legs	1	3.3	1	53	R
Ruby-throated Hummingbird	1	3.3	1	53	R
House Wren	1	3.3	1	53	R
Veery	1	3.3	1	53	R
Parula Warbler	1	3.3	1	53	R
Yellow Warbler	1	3.3	1	53	R
Myrtle Warbler	1	3.3	1	53	R
Field Sparrow	1	3.3	1	53	R
White-throated Sparrow	1	3.3	1	53	R

The bird names used in this table are taken from the A.O.U. Check-list of 1931.

oak, red maple, pin cherry (*Prunus pennsylvanica*), and birch; numerous sumac bushes are also found around the cabins. Grasses, clover, blueberries, and bracken (*Pteris aquilina*) form the main ground cover.

In order to divide the early mornings among the four routes I arranged a four-day schedule of walks. Four walks were made each day beginning on the following hours: 5:00 A.M.; 7:30 A.M.; 2:00 P.M.; 4:30 P.M. The routes covered were rotated each day so that in a period of four days, each route was traversed at a different time of day.* The weather conditions each day were noted and recorded.

Thus the material serving as a basis for this analysis consists of 120 lists of species; 30 lists for each of four different habitats visited each day for a total of 30 days between July 2 and August 14, 1941. The birds heard as well as those seen were recorded in each case. The per cent of frequence for each species was derived by dividing the number of days on which the species was observed by the total number of days, namely, 30. A separate list of frequences for each of the four habitats was made in addition to a composite list for the entire area. The total numbers of each species were recorded and it was found that the species seen in largest numbers were generally those seen most frequently.

One study of bird frequences was made in the vicinity of the Biological Station by Linsdale (1936) during the summer of 1924. Linsdale based his percentages on 50 days' field work. His study area was much larger and less compact than mine. He included, for example, several trips to points on both Lake Huron and Lake Michigan. The results of our two studies cannot, therefore, be satisfactorily compared.

Table 2 shows the number of species found in each frequence-class and the ratio between the number of species in each class and the total of species both for the present study and for Linsdale's studies.

TABLE 2

	Present study		Linsdale's studies					
			Michigan		Kansas		California	
	No. of species	Ratio	No. of species	Ratio	No. of Species	Ratio	No. of Species	Ratio
Class A	34	.43	62	.59	133	.68	111	.73
Class B	11	.14	16	.15	32	.16	20	.13
Class C	10	.12	11	.10	13	.07	7	.05
Class D	12	.15	10	.09	6	.03	5	.03
Class E	13	.16	5	.05	10	.05	8	.05

It will be noted that there are more species of high frequences in the present study than in the previous studies by Linsdale. This is due

* The trip to North Fishtail Bay and back (Routes 1 and 2) covered a period of approximately five hours; the route along State Street (Route 3), forty-five minutes; and the hill (Route 4), one and one half hours.

to two factors: (1) Exactly the same territory was covered each day. This was not the case in the earlier studies. (2) The bird population was more stable and homogeneous due to the fact that the study extended only through the breeding season and few non-breeding birds were included.

Table 1 shows the species seen during the period of observation, listed in order of decreasing frequence; it shows the number of days on which the species was seen, the per cent of frequence, the total number of individuals of each species recorded, the rank in number (the species observed in greatest abundance ranks first and the one seen in least abundance ranks fifty-third), and gives a frequence rating according to the following scale:

A (abundant)	90 to 100 per cent frequence
C (common)	65 to 89 per cent frequence
M (moderately common)	31 to 64 per cent frequence
U (uncommon)	10 to 30 per cent frequence
R (rare)	1 to 9 per cent frequence

The fact that the frequences agree very closely with the total numbers of individuals seen bears out Linsdale's statement (1932:225) that the numbers of individual birds of one species seen over a period of time will parallel the frequence of occurrence of that species. The chief exceptions in my study to this statement were the Purple Martin, the Bank Swallow, and the Herring Gull. The exceptionally high number of Martins and Bank Swallows was due to the presence at the Station of colonies of each. Both groups migrated before the end of the period of observation, thus preventing them from showing a frequence of 100 per cent. The number of Herring Gulls recorded was much less than the number of Ring-billed Gulls although the frequences are almost the same. The flocks of gulls that fed on the lake were made up largely of Ring-billed Gulls, but a few Herring Gulls were always present.

The use of Raunkaier's Law of Frequence is a highly accurate method for determining the frequence of birds in a region of the type surrounding the Biological Station. It involves simple calculations and is easily represented graphically. At the same time, it gives a precise picture of the bird life of a habitat which can readily be compared with that of another habitat (when another habitat is studied in the same way) or with the bird life of the same habitat studied in the same way at a different time.

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ORNITHOLOGISTS OF THE UNITED STATES ARMY MEDICAL CORPS. By Edgar Erskine Hume, Johns Hopkins Press, Baltimore, 1940: 7 x 10 in., xxv + 583 pp., frontisp. and 109 figs. $5.00.

The publication of a volume of biographies of ornithologists is a notable event, especially when the author has done a scholarly job and the publishers a fine piece of book making.

We are all familiar with the British army officers' great tradition of natural history investigation in the remote parts of the earth but few Americans have realized the important part that has been played by United States Army officers, particularly those of the Medical Corps. Col. Hume, formerly Librarian of the U.S. Army Medical Library, is well qualified to be the biographer of the Army Medical Corps ornithologists and obviously he has worked long and faithfully. He started to write a brief paper but it soon grew into a series of articles, the first of which was actually published in the *Bulletin of the History of Medicine* in 1940. Fortunately the Johns Hopkins Press then decided to publish the manuscript in this handsome and much more convenient book form.

The thirty-six biographies are arranged in alphabetical order and contain a vast amount of new information as well as much that was never before thus correlated. At the close of each chapter is a list of the principal sources. Included in most of the biographies are excerpts of the subject's published and unpublished writings. Certain of the quotations strongly confirm this reviewer's old suspicion that ornithologists are commonly very bad poets.

There is an interesting foreword by Alexander Wetmore who properly calls attention to the important part that Baird had in promoting and encouraging the work of many of these pioneer ornithologists.

Col. Hume modestly disclaims any knowledge of ornithology but his book contains much evidence to the contrary. Our confidence in the reliability of the book is partly the result of our almost complete failure to detect typographical slips or errors of any kind. The usefulness of the book is enhanced by an excellent index.—J. Van Tyne.

GENERAL NOTES

A Golden Plover in Central New York in Spring.—On March 21, 1942 a Golden Plover (*Pluvialis dominica dominica*) was found in an upland field close to Cayuga Lake, Kings Ferry, Cayuga County, New York by a group of Cornell University ornithology students which included myself. It was in company with three Killdeers (*Charadrius vociferus*). The next day, accompanied by Harrison Tordoff and Herbert Bleich, I returned and found the bird again in exactly the same place. It was feeding busily despite an inch of snow which had fallen during the night. The plover was collected and is now in the Louis Agassiz Fuertes Memorial Bird Collection at Cornell University. Mr. Lloyd Hulbert made a complete dissection and found it in excellent condition with no apparent injuries or disorders of any sort. The full stomach contained earthworms (*Lumbricus*) and numerous disintegrated insect remains. The specimen is a male in winter plumage. The testes were very small, 1 x 3 mm.

I am aware of very few authentic spring records of the Golden Plover in New York State: April 7, 1882 (one) and May 10, 1885 (two), both from Shinnecock Bay, Long Island (E. H. Eaton, Birds of New York, 1, 1910: 347). A. C. Bent (*U.S. Nat. Mus. Bull.*, 146, 1929: 190) gives records for Long Island City, April 17, and Fair Haven Light, May 3, but does not give the source. W. Sedwitz (*Proc. Linn. Soc. N.Y.* Nos. 50–51, 1940: 55) reports one seen in the New York City region on April 18, 1937. There is apparently no previous spring record for the Finger Lakes region.—Robert M. Mengel, *Cornell University, Ithaca, New York.*

A Nest of the Acadian Owl in Michigan.—On May 1, 1942, I discovered an adult Acadian Owl (*Cryptoglaux acadica*) and her brood of seven young in an artificial squirrel den at the Swan Creek Wildlife Experiment Station in Allegan County, Michigan. The young ranged in age from approximately five days to two weeks. The smallest of the brood was downy and quite helpless, while the oldest was almost entirely feathered out.

The artificial squirrel dens in use at the experiment station are wooden boxes 18 inches high by 12 inches square made of one-inch pine lumber. The entrance, placed near the top of one side, is 3 inches in diameter. The box in which the owls were found is 21 feet high in a 13-inch (DBH) black oak (*Quercus velutina*) in an upland area composed mainly of second growth black oak and white oak (*Quercus alba*).

There are only two other records for the Acadian Owl in the experiment station files. One is of an adult found dead near the Kalamazoo River on October 25, 1939, and the other of one taken alive in a box trap on November 29, 1939.—Philip Baumgras, *Game Division, Michigan Department of Conservation, Lansing, Michigan.*

Western Burrowing Owl in Indiana.—On Sunday, April 12 of this year I collected a male Western Burrowing Owl (*Speotyto cunicularia hypugaea*) in McClellan Township, Newton County, Indiana. Apparently this is the second record for this species from Indiana, the first specimen having been taken April 16, 1924, in the dune region of Porter County by Ashley Hine (*Auk*, 41, 1924: 602).

The location for the 1942 record was about two miles from the Indiana-Illinois state line. Spotted from a car, the bird sat on a mound at the mouth of a woodchuck burrow atop the spoil bank of a dredge ditch bordering a county road. When struck with a charge of light shot, the owl pitched into the burrow. It was recovered from a depth of about five feet. The head and neck region of the owl was abundantly parasitized by two species of mallophaga *Philopterus*

speotyti (Osborn) and *Kurodaia* sp., probably *K. pectinatum* (Osborn). Dr. B. B. Morgan of the University of Wisconsin identified the lice. The skin of this owl, prepared by Clinton Conaway, is now in the collection of the Purdue Wildlife Laboratory.

I was with Dr. W. H. Elder when he took a male Burrowing Owl that was the first Wisconsin record (*Passenger Pigeon*, 1, 1939: 62). The date of the Wisconsin record was Sunday, April 9, 1939. It is interesting that the first Indiana record was made on April 16, and the first Illinois record was made April 9, 1930 by E. L. Lambert (*Wilson Bulletin*, 42, 1930: 213). The collection dates for all of these owls fall within a calendar week. All of the birds were males. These facts may be pure coincidence. On the other hand they may indicate a tendency of male Western Burrowing Owls to move eastward in the spring.—CHARLES M. KIRKPATRICK, *Department of Forestry and Conservation, Purdue University, Lafayette, Indiana.*

Strange Behavior of Two Cliff Swallows.—On July 7, 1940 while watching a colony of Bank Swallows (*Riparia riparia*) in the bank of the Ohio River three miles west of Henderson, Kentucky, we witnessed very peculiar actions on the part of two Cliff Swallows (*Petrochelidon albifrons*).

During a period of about ten minutes both birds entered holes in the midst of the Bank Swallow colony, and disappeared completely from sight. One bird only entered once, emerging in a short time; the other went into a different hole at least three times, remaining a minute or more in each instance. This procedure attracted no attention from any of the Bank Swallows, and we were unable to ascertain whether the holes thus entered were occupied. Many of the Bank Swallow holes, however, contained well-grown young. Both Cliff Swallows were collected and proved to be male and female, well past full breeding condition. No evidence of Cliff Swallow nests was found anywhere in the area, and no others of the species were seen during our two day stay.—BURT L. MONROE, *Anchorage, Kentucky* and ROBERT M. MENGEL, *Cornell University, Ithaca, New York.*

Du Bus' Types of Cyanocorax unicolor and Sylvia taeniata.—The type locality of *Cyanocorax unicolor* was given in the original description (*Bull. Acad. Roy. Sci. Belgique*, 14, pt. 2, 1847, séance of Aug. 7: 103) simply as Mexico. It was later (Esquisses Ornithologiques, livr. 4, 1848: pl. 17 and text) restricted to Tabasco, although two localities in Oaxaca and also Vera Paz, Guatemala, were included in the range. Hellmayr (*Field Mus. N.H., Zool. Ser.*, 13, pt. 7, 1934: 58, footnote) has very properly challenged the supposition that this species could occur anywhere in Tabasco and suggested a re-examination of Du Bus' type in the Brussels Museum. I examined this type in July, 1939. It is definitely and in detail the specimen from which was drawn the description and subsequent plate. Du Bus had two other birds from Mexico, respectively from San Pedro, near Oaxaca, and Tepitongo, Oaxaca but both of them are young of the year and have parti-colored bills. These were mentioned by Du Bus but have no standing as co-types, although someone (probably Dubois) has marked one of them as such both on the label and in the catalogue. The type, collected by Auguste Ghiesbreght in "Tabasco," probably in the spring of 1838 or 1839, is a very good example, in color, and in size an extra large one (sex not indicated; wing, 172; tail, 165), of the race currently known as *Aphelocoma unicolor coelestis* Ridgway. That name of course becomes a synonym of *Aphelocoma unicolor unicolor* (Du Bus) and the south-central Mexican race will probably be known as *Aphelocoma unicolor concolor* (Cassin) *Proc. Acad. Nat. Sci. Phila.*, 4, 1848: 26). A critical re-examination of Cassin's type must be made, however, especially in view of the initial uncertainty of the type locality.

As to the purported type locality of *Cyanocorax unicolor*, both Pierce Brodkorb and E. A. Goldman inform me that there are no mountains in Tabasco anywhere nearly high enough to accommodate this cloud-forest species which south of the Isthmus of Tehuantepec has never been taken below 7,000 feet. The only explanation is either that Tabasco took in more territory then than now, or that Ghiesbreght (who definitely did some collecting in Tabasco) entered an adjacent part of Chiapas without being aware of the fact. Ghiesbreght secured other high mountain species in "Tabasco," such as *Turdus rufitorques* and *Peucedramus olivaceus*. *One* of these might have been secured in Tabasco through some fortuitous circumstance, but that all three could have come from there verges on the impossible.

Sylvia taeniata Du Bus (*Bull. Acad. Roy. Sci. Belgique, ibid.*: 104) has always been placed in the synonymy of *Sylvia olivacea* Giraud. The type, an adult male in the Brussels Museum, is from "Tabasco" and, although the catalogue does not so state, was without doubt collected by Ghiesbreght in the same locality as the type of *Cyanocorax unicolor*. It is the race now known as *Peucedramus olivaceus aurantiacus* Ridgway and that name now becomes a synonym of *Peucedramus olivaceus taeniata* (Du Bus). The wing and tail measurements of the type are 70 and 49.5 mm., respectively. Incidentally, Bonaparte's statement (Consp. Gen. Avium, 1, 1850: 309) that the subsequent plate (Esq. Orn. livr. 6, 1850: pl. 28) was from a specimen from San Pedro, near Oaxaca, is not correct. The type is the basis of the plate and I may add that Wilhelm Meise made a similar notation on the tag in 1938.

While it is certain that Chiapas, not Tabasco, is the type region of both of the above birds, I have no first hand knowledge of the topographical details of that state. Obviously a spot as close as possible to the Tabasco boundary should be selected, but a definite selection may well be left to Pierce Brodkorb, in view of his extensive work in Chiapas.—A. J. VAN ROSSEM, *University of California, Los Angeles.*

A Nest of the Brown Jay.—Among the commonest and most noticeable birds of southern Tamaulipas is the so-called *Papán*, or Brown Jay (*Psilorhinus morio*). It wanders about the brushy lowlands in companies of four or five to ten to twelve (often family parties, apparently) mobbing such enemy species as lynxes, owls, or human beings, and feeding on various fruits and insects and an occasional lizard, mouse, or nestful of young birds. It is exceedingly noisy, its customary call-note being a loud *pee-ah* that is followed by a "hiccup" resulting from the sudden inflation or deflation of its odd furcular pouch (see Sutton and Gilbert, *Condor*, 44, 1942: 160–165). It is decidedly gregarious, even during the nesting season. An alarm cry from any single Jay is sufficient to cause all the Brown Jays of the neighborhood to foregather promptly.

Along the Sabinas River, in the Gomez Farias region of Tamaulipas, Brown Jays came daily to the Rancho Rinconada where our party lived from March 12 to May 4, 1941. During this period we rarely saw a lone Brown Jay. As early as March 21, we watched a bird carrying material to an exposed crotch twenty feet from the ground, but this nest was never completed. Twig-carrying (which we interpreted as nest building) was observed almost daily throughout latter March and the whole of April. Two birds carrying twigs were seen on several occasions. Numerous partly built or old nests were found. These were broad, not very deeply cupped nor neatly lined, and usually in comparatively open woodland from fifteen to thirty feet from the ground.

The only occupied Brown Jay nest discovered during our stay at the Rancho was found by our aide, Maclovio Rodriguez, who happened to frighten the bird from its nest as he was thrashing through a wild pineapple thicket looking for tinamous, April 21. There were three eggs in it then.

We went to this nest several times during the following two or three days, finding the sitting bird (presumably the female) to be surprisingly wary. On April 23 one of our party, Robert B. Lea, climbed to the nest. There were six eggs. These evidently comprised the complete set, for when Lea returned, several days later, to take the photograph reproduced herewith, no more eggs had been added. They were uniform in coloration, all being buffy gray, thickly and evenly spotted with dark brown. They were not collected.—GEORGE MIKSCH SUTTON, *Ithaca, New York*, and OLIN SEWALL PETTINGILL, JR., *Northfield, Minnesota*.

A Robin Anting—On July 12, 1942, Dr. George M. Sutton and I watched a Robin (*Turdus migratorius*) "anting" on the Edwin S. George Reserve, near Pinckney, Livingston County, Michigan. Neither of us had ever observed "anting" in birds before and we were keenly interested in this unusual behavior.

We saw the Robin on a large ant hill that we estimated to be about five feet in diameter and nearly two feet high. This hill was situated in a growth of bushes and saplings near the edge of a swamp. The bird flew from the ant hill into a nearby bush when we first noticed it, but came back onto the hill a few moments after we had retired several paces. We observed that the bird appeared to pick up the ants in its bill, placing them at the base of the primaries, chiefly at the wrist joint, and occasionally at the base of the tail. We did not see any ants crawling up the legs of the bird. The bird was quiet throughout the period of observation and its actions appeared most definite and purposeful. The Robin left the ant hill when a car was parked nearby, but returned to the hill a few minutes after the people walked away.

Altogether the Robin spent at least fifteen minutes on the ant hill (9:10 to 9:20 A.M.). As far as we could determine, the bird appeared to be normal in every way. Its plumage was wet and disarranged. We believed that it had either bathed or had become wet from the heavy dew that was still on the bushes and grass. Although we saw no definite evidence of molt, the worn plumage of the bird indicated that the molt was about to begin. Sutton flushed a Robin and a Wood Thrush (*Hylocichla mustelina*) from this same ant hill on August 23 and both of these birds had short, newly molted tails.

Ants from the hill were identified by Professor Frederick M. Gaige as *Formica exsectoides exsectoides* (Linn.). These ants are good biters and do not sting. They are capable of spraying formic acid from their abdomens; in fact, Prof. Gaige characterized them as "one of the richest extruders of formic acid in North America."

The literature on the "anting" of birds has recently been reviewed by McAtee (*Auk*, 55, 1938: 98–105) and Nice (*Auk*, 57, 1940: 520–22).—ARTHUR E. STAEBLER, *University of Michigan Museum of Zoology, Ann Arbor, Michigan.*

European Starling Nesting in a Bank Swallow Burrow.—On May 9, 1942, while inspecting the walls of a large gravel pit about nine miles northwest of Albany, New York, I observed an adult Starling (*Sturnus vulgaris*) fly from one of the Bank Swallow (*Riparia riparia*) burrows there. The Starling carried a pellet of excrement in its bill, good evidence that it was attending young within.

In the afternoon of May 12, I again visited the gravel pit. Shortly after my arrival an adult Starling emerged from the burrow with a pellet of excrement which it dropped after flying about sixty feet.

This gravel pit lay near a surfaced and moderately traveled highway extending over rolling, open country in an agricultural community. Several rural homes and the usual complement of farm buildings were in the immediate neighborhood.

The walls of the pit, which had been excavated in a roughly circular manner over an area of perhaps three acres, were precipitous and varied in height from 15 to 30 feet. The burrow occupied by the Starling was in the deepest portion of the pit. Only two or three other Bank Swallow burrows were on the same face of the bank as the one occupied by the Starling. This bank face and the burrow entrance were directed north. However, just around a sharp promontory, a few feet southeast of the Starling's burrow, were some 60 additional Bank Swallow burrows either completed or in process of construction. Their entrances faced the east. The swallows themselves were swarming about these burrows, entering and emerging from them frequently.

Obviously the burrow occupied by the Starling had been excavated by Bank Swallows. It was three feet below the rim of the pit and about 25 feet above its floor. The opening to it had been eroded a little so that it was higher than wide. However, it was not large enough to permit insertion of my hand. The burrow itself was 19 inches deep. With a small flashlight I could plainly see the well constructed, grass nest and two young Starlings 5 to 6 days old. They appeared to be in good condition and intermittently broke forth in unison with the characteristic hunger call.

During the course of my examination, which comprised some 70 minutes, one of the adults approached with food two or three times. One parent, perhaps the same one, expressed vocal dissent at my presence on each of two or three fleeting aerial sorties. But within ten minutes after I had left the immediate vicinity an adult Starling entered the burrow with food for the young. Other Starlings obviously were nesting about the nearby farm buildings and from time to time some of them alighted in the tall trees at one side of the gravel pit.

In the more or less intensive observation and study of the Bank Swallow which I have carried on over a period of twenty years this is the first time that I have found a Starling occupying a burrow of that bird as a nesting place.—DAYTON STONER, *New York State Museum, Albany, New York.*

EDITORIAL

There will be no annual meeting of the Wilson Club this year. Our Council feels that the least we can do at this difficult time is to cooperate with the Government by saving gasoline and tires and simplifying transportation and housing problems in all possible ways. We shall miss the good fellowship of the meeting. We shall not hear our friends' reports on interesting work they have done and places they have visited. But our *Bulletin* will keep us informed and unified.

As for our business affairs, one item will demand our attention—the election of officers. This the Council feels may best be handled by (1) appointment, now, of a nominating committee; (2) preparation of a slate by this committee; (3) printing and distributing ballots to all members about the time the annual meeting would have been held; and (4) voting, by mail.

I hereby appoint Margaret Morse Nice, Herbert L. Stoddard and Jesse T. Shaver as our nominating committee.

Our secretary probably will not send out an annual letter this year, since that letter is concerned primarily with the numerous details of the annual meeting. In the December *Bulletin* there will be a report on the voting and other business.

Our Club is vigorous and full of good spirit, and cancellation of this year's meeting will not stop our growth. But there may be difficult times ahead. Many of our members already are serving in our country's armed forces and there is no telling how many more will go. The membership will have to be prepared to cancel the meeting in 1943 if necessary, and perhaps to get on with a smaller *Bulletin*. This may sound pessimistic, though I hope it does not. A possible advantage of war is that in the midst of the distress and bewilderment we suddenly perceive the true value of taken-for-granted things. If we were asked to put down in words what the United States is fighting for now, most of us would write 'democracy,' 'religious freedom,' 'the right of free speech,' and the like, but have in our minds and hearts all the while the investigations that are coming on so well but are only half-done, the manuscript that is almost completed, the plans for the expedition we want so much to make. Is it not, in the last analysis, the right to think and live and do the work that interests us, really what we are willing to give our lives in defending?—George Miksch Sutton.

New Federal regulations require that we turn in soon for scrap metal all old engravings which are no longer definitely needed for future publication. All engravings used in the *Bulletins* published at Ann Arbor are now in the Editor's files. Any author who wishes the engravings used in his contributions to the *Bulletin* should write immediately to the Editor and request that they be sent to him transportation collect. The only cost involved will be that of transportation.

Ornithological News

We have received word that the following Wilson Club members are now in the Army, Navy, or Marine Corps: Robert W. Allen, G. A. Ammann, F. S. Barkalow, C. Edward Carlson, Ben Coffey, Donald P. Duncan, R. P. Grossenheider, R. C. Hanson, Arthur S. Hawkins, Richard G. Kuerzi, Roger W. Lawrence, Robert B. Lea, Robert A. Lessard, Lester J. McCann, Frank J. Manz, Jr., Burt Monroe, W. R. Taylor, Leonard J. Uttal. James Boswell Young is now with the Department of Justice.

The Fish and Wildlife Service has moved to Chicago and set up temporary quarters in the Knickerbocker Hotel. Permanent quarters will be in the Merchandise Mart. The Section of Distribution and Migration of Birds, which includes the bird banding files, has been moved to the Patuxent Research Refuge at Bowie, Maryland. A liaison office is being kept in Washington, D. C.

WILDLIFE CONSERVATION

Destruction of Waterfowl by Oil.—Along the Atlantic coast of Canada large quantities of floating oil, most of it present as a result of war activities, caused the destruction in three local areas of some thousands of seabirds during the latter part of the winter of 1941–42. The areas in which such destruction chiefly occurred were the Grand Manan Archipelago, on the southwest coast of New Brunswick; part of the coast of Shelburne County, in extreme southwestern Nova Scotia; and a part of the coast of Halifax County, Nova Scotia.

The birds that were thus destroyed included several thousands of Eiders, of Brunnich's Murres, and of Dovekies; hundreds or a few thousands of Mergansers, of Old-squaws, of Golden-eyes, of Black Guillemots, and of Razor-billed Auks; and at least a few American Scoters, White-winged Scoters, Scaups, Herring Gulls, and Great Black-backed Gulls. Although many Black Ducks winter in areas affected, this species appears to have suffered very little from the oil, for only one Black Duck certainly identified was reported as having been found dead as a result of contact with it.

Whether the Eiders that died as a result of these oil pollutions were *Somateria mollissima borealis* or *S. m. dresseri* is not known. It is of interest in this connection, however, that along the north shore of the Gulf of St. Lawrence, where *dresseri* is the common breeding race, reports from officers of the Canadian Department of Mines and Resources indicate that in the summer of 1942 there was no apparent diminution of the population of nesting Eiders and these birds enjoyed a very successful season of reproduction.—HARRISON F. LEWIS.

Resolution.—"In times of stress, such as the present, there is danger that public resources of permanent value may be exploited unduly to furnish food and other materials.

Be it resolved, therefore, that the American Society of Mammalogists at its 24th annual meting, April 3, 1942, goes on record as opposing the use of any such materials from National Parks, National Monuments, or National and State Wildlife Refuges, unless it be demonstrated that such materials cannot be obtained elsewhere." (*Jour. Mammalogy*, 23: 227, 1942.)

Drought

Now that the intense drought of recent years has been broken, it is easy to look upon it as no more than an interlude, no matter how unpleasant. The rains have come, the drought is broken, life can go on again after the same old pattern. But can it? Tons of topsoil, the slow reserve of centuries, are gone, blown away. It can be built again, but no man now living will sift it through his fingers. Still, the land is green again—Not the same land, and not the same green. Here are figures, as of the summer of 1941: "Square-foot samples of surface soil were collected from 49 drought-damaged ranges and prairies in Nebraska, Kansas, and Colorado, and viable seeds germinated. Seedlings grew at the average rate of 67 per sample. Forty species of forbs occurred, of which more than 96 per cent were annual weeds. . . . There were 26 species of grass seedlings of which 20 per cent were ruderals. . . . Numbers and kinds of seedling grasses were determined in June in each of 25 square-foot areas in each range or prairie. Extensive soil sampling and study of numerous rainfall records showed that an almost continuous supply of moisture had been available to promote germination and establishment of seedlings. . . . Of 550 square feet of soil on which seedling grasses were counted, 37 per cent supported none. Seedling grasses were especially rare in drought-stricken and dust-covered ranges of western Kansas. . . . Viable seeds of native perennial forage grasses, with rare exception, were present in such small numbers (26 per square foot) as to be of limited value, when seedling hazards are considered, in restoration of the vegetation. Average distribution of perennial grass seedlings on

the ranges and prairies was 4.3 per square foot; in mixed prairie alone, 2.4 per unit area. Even if all seedlings (exclusive of the stoloniferous buffalo grass) had survived and made a maximum growth in mixed prairie, they would have increased the cover less than 2 per cent." (J. E. Weaver and I. M. Mueller, "Role of seedlings in recovery of midwestern ranges from drought," *Ecology*, 23, 1942: 275–294.

The immediate effects of the drought were spectacularly severe; the after-effects may be less plain to the uninitiated but they may well be equally severe. They will persist over a vastly longer period of years.—F.N.H.

Reforesting Strip-mines

"The first year of operation of Indiana's law requiring the reforestation of areas from which coal has been removed by the stripping or open-cut method has resulted in the planting of approximately two million trees on 1,617 acres of such land. . . . Under provisions of the 1941 law, each company mining coal in Indiana by stripping off the soil overlaying the coal is required to reforest an area equal to that stripped. In addition the company must reforest an additional area equal to one per cent of the acreage stripped [in the past], a provision which eventually will complete the reforestation of older stripped sections." (*Outdoor Indiana*, 9, No. 6, 1942: 7.)

"Control" of the Golden Eagle in Texas

From Texas come officially sponsored news stories advocating control of Golden Eagles by use of the shotgun from airplanes. An official kill of 1,338 eagles since 1930 is reported.

The control of eagles at particular spots where new plantings of antelope have been made, or where some remnant of mountain sheep is slipping, might well be a practical necessity for a temporary period. To urge the flying public to pursue and shoot eagles is quite another matter, and might readily extirpate the species from the western ranges. Texas has been doing admirable work in wildlife conservation, but this eagle campaign seems quite out of harmony with the solid, tolerant common sense characteristic of other undertakings of the Texas Commission.—Aldo Leopold.

Wildlife Conservation Committee
Frederick N. Hamerstrom, Jr., Chairman

ORNITHOLOGICAL LITERATURE [1]

CATALOGUE OF BIRDS OF THE AMERICAS AND THE ADJACENT ISLANDS. By Charles E. Hellmayr and Boardman Conover. Field Museum of Natural History, Zool. Series, 13, part 1, number 1: vi + 636 pp. April 30, 1942. $5.09 postpaid.

After some unavoidable delay this keenly anticipated volume of the "Catalogue" by Hellmayr and Conover has appeared, and that it fully lives up to the standard set by previous parts goes without saying. The matter contained deals with the Orders Rheiformes, Tinamiformes, Galliformes, Gruiformes, and Columbiformes. The sequence of families and genera within these Orders follows that of Peters' "Birds of the World," though the grouping of the Orders themselves necessarily throws them, and the Orders to follow in future volumes, out of the Peters sequence. Presumably, this departure is to take full advantage of Mr. Conover's extensive knowledge of certain groups: in any event the arrangement will cause no inconvenience of moment to the public for whom the work is intended. The species and subspecies arrangement within the families adheres in the main to that of Peters, but some variation is to be noted here and there. One new name is proposed: *Penelope dabbenei* to replace *Penelope nigrifrons* Dabbene (not of Lesson, 1831).

In spite of the dual authorship, the method of treatment remains the same as in preceding volumes. The bibliographic references are invaluable and the commentaries which occur as footnotes on almost every page constitute at times almost a systematic review of a genus or species, although this the authors modestly deny in their preface. As in previous volumes, too, there is emphasis (it will be called over-emphasis in some quarters) on the use of trinomials for forms which are believed to be representative, whether or not intergradation has been shown. The application of this principle is too controversial a subject to be discussed in a short review. Individual systematists will, as always, follow their own beliefs and certainly none can quarrel with Hellmayr and Conover for so consistently following theirs.

So far as the territory covered by the American Ornithologists' Union "Check-list" is concerned, there seems to be only one basic name change. Transfer of the old, familiar name of the White-faced Glossy Ibis to the Limpkins (p. 301) is to be regretted but there is no alternative under existing rules. The races of the Rock Ptarmigan, *nelsoni, kellogae,* and *dixoni* are united (p. 205) under the single name of *americanus* Audubon. However, this and a number of other items relative to the inclusion or rejection of proposed subspecies, and of the reduction to subspecific status of forms now carried as species, are matters which will doubtless receive due consideration from the Committee on Classification and Nomenclature in preparing the next edition of the "Check-list."

Typographically, the work is a product of the Field Museum Press, a fact which makes further comment in this respect superfluous.—A. J. van Rossem.

LIFE HISTORIES OF NORTH AMERICAN FLYCATCHERS, LARKS, SWALLOWS, AND THEIR ALLIES. ORDER PASSERIFORMES. By Arthur Cleveland Bent. United States National Museum Bulletin 179, 1942. xi + 555 pp., 70 plates. $1.00. Supt. of Documents, Washington, D.C.

Persons already familiar with the Bent Life Histories require no reminder of the appearance of new volumes, but newcomers to bird study need to learn of them early if they are to get copies. The accelerated rate of issue of recent numbers brings reassurance that we may soon have the completed series. Already this is becoming the most widely sought work on American birds.

Accommodation to an expanding field of study is shown in part by the tendency to use more help in the preparation. Mr. Bent recognizes that accounts written

[1] For additional reviews see pages 161, 182, and 210.

by a person thoroughly familiar with the species may be more satisfactory than ones prepared chiefly with compiled material. Since his own experience was not sufficient for every species, he has solicited at least thirteen accounts for this volume, and these adhere closely to the arrangement of material adopted for this volume. Especially notable for its thoroughness and originality is the chapter on the Prairie Horned Lark by Gayle Pickwell.

Source materials for this work have been modified greatly by discoveries and changes in mode of study, which came soon after the start of its preparation. Retention of the original plan and objectives, however, has made the life histories more valuable than if they had been changed to meet the demands of some recent fad.

A reader is not likely to be equally interested in all the accounts. For example, the reviewer found that of the 47 species treated he was unfamiliar with 18, slightly familiar with 6, familiar with 17, and had conducted prolonged studies of 6. He turned first to the last group of life histories, and he has not yet read any of the first group!

The task of finding and sorting information has become too great to expect all the important items to be included for any species. Even though the assembly has been done remarkably well, we wonder sometimes what basis has been used for acceptance or rejection of material, especially in the distributional section. Published records, in some instances, extend the areas or seasons given. Some records cited, which are marginal, would carry reassurance if accompanied by some reference to the authority or place of publication. This applies especially to the flycatchers. A suspicion that the nest shown at the top of plate seven was not that of the Cassin Kingbird was verified when Mrs. Grinnell learned from the photographer that the locality was Wild Horse Mountain, about five miles west of Clear Lake, Modoc County, in the northeast corner of California, and that he took the parent bird to be an Arkansas Kingbird.

It seems obvious that insufficient basis is available to justify writing a history for each geographic race of the passerine birds. Modification of the plan so as to treat full species as units would condense the books and make them of considerably greater usefulness. The features of behavior treated rarely are known well enough to permit adequate treatment for separate races. The user of the work might be grateful also if the accounts of distribution were simplified. He will consider the volume not as an index to all facts concerning flycatchers, larks, and swallows, but as a valuable abstract of the hidden published knowledge of those birds.—Jean M. Linsdale.

NESTING BIRDS AND THE VEGETATION SUBSTRATE. By William J. Beecher. Chicago Ornithological Society. 1942: 6 x 9 in., 1–69 pp., 1 pl., 10 figs. $1.00 at Field Museum Book Shop.

The quality of the groundwork for part, at least, of this paper is indicated by the number of nests found on the 482 acre study area: about 500 in 1935, about 700 in 1936; in 1937, the one year on which the paper is based, 1332 nests are tabulated, although the text (pp. 1 and 2) says "more than twelve hundred determined to exist" of which "over 85 per cent . . . were actually found". The description of plant succession, both geologic and modern, on the area is interestingly and thoroughly done; the account of the present plant communities and their general relations to nesting is good, barring a few questionable interpretations stated baldly as fact. There follows a section in which for each nesting bird is listed the total number of nests, the number in each cover type and the number of acres of that type, the calculated number of nests per hundred acres, and the number of acres (all cover types together) per nest.

The value of this section is reduced by a "correction" of the acreage of some of the cover types, a correction which works in one direction only. That is, about 45 per cent of two marsh communities was considered to be "unavailable to ground nesting birds," hence omitted from the total acreage, because of unusually

high water, while a neighboring area which "proved unusually attractive" for nesting that year was included at face value (p. 15). "Likewise, because most of it occurred in strips along roads or railway embankments and was clearly unused by birds for other reasons" (p. 28)—whatever that means—about 51 per cent of the prairie disclimax was thrown out. The same half-logic shows up in the nest density figures. Acres-per-nest was worked out to two decimals, even in the case of single nests, giving the appearance of extreme precision; yet the nesting density of the Prothonotary Warbler was calculated by dividing the number of nests into the total acreage of "Modified Woodland" (mainly "of the oak-hickory type" (p. 24)), of which only a part fronts on water.

A further refinement of the basic data follows in the addition of a numerical value "feet of edge per acre," determined by dividing the total boundary of all the scattered blocks of a particular community by the total acreage of that community; a table was made to show, for each plant community, the actual acreage, the "available" (i.e., "corrected") acreage, the number of feet of edge per acre, and the number of nests of each species, distinguishing between first nests and later or dummy nests.

In analyzing his data, Beecher limited himself almost entirely to the single aspect of nesting cover, the "vegetation substrate" of the title. His main points are two—an attempt to measure more exactly the importance of edge, or mixture of cover types, and to show the relation between inherited nest patterns and plant life-forms as the determining factor in nest distribution—neither of which could be proved by one year's study on a single small area, particularly when that year was one in which "the water table in May stood six inches higher than normal" (p. 15).

To measure edge effect quantitatively, Beecher converted the number of feet of edge per acre (using the "corrected" figures) to feet of edge per 100 acres, for comparison with the calculated number of nests per 100 acres. A scatter-plot based on these figures is said to show a definite, positive correlation between feet-of-edge and nest-density, but since at least two other variables (different kinds of cover, different kinds of birds) are also involved, the conclusion seems too strongly stated. Attempting to measure even more closely, he took a 38 acre sample (mostly marsh) and didived it into quarter acre quadrats, in each of which he counted both the number of plant communities and the number of nests; analysis of these data gave a more precise and quantitative expression of the original conclusion. Unfortunately—and one has to turn back 25 pages to find this—the sample plot contains a large amount of the "unavailable" cover thrown out earlier, as well as the 11 acres that were that year "unusually attractive" for nesting. This time, the "unavailable" acres are counted in.

Beecher's discussion of his second major thesis is stimulating but inexcusably one-sided. Thus, those species which nest earliest do so "because they are notably independent of vegetation of the year" (p. 48): there is no mention, much less disproof, of the possibility that they may seem independent because physiologically they must nest early and must take their nesting cover as they find it. Again, a half-page or so develops the theory that the Prairie Marsh Wren prefers to nest in *Typha* and *Carex lacustris* because these plants are particularly suited to its nest-building habits; the fact that the Short-billed Marsh Wren, with a very similar nest, uses a different sort of cover is dismissed in a few lines, "its prime requirement being a drier situation" (p. 54)—debatable, at the least.

There are many other instances of careless thinking, and several of careless workmanship. One example of the latter: in the text-references to the bibliography I counted 20 mistakes, including references to four papers that were not listed at all.

There is material here for a fine paper on a local nesting study, and a beginning toward a much broader exploration of the factors which underly the selection of nesting cover. The one needs only a further analysis of data already in hand, but the other enjoins a great deal more of both digestion and assimilation. Their present mésalliance is not ready for serious consideration.—F. N. Hamerstrom, Jr.

SHORT PAPERS

ALDRICH, JOHN W. New Bobwhite from Northeastern Mexico. *Proc. Biol. Soc. Wash.*, **55,** June 25, 1942: 67–70. (*Colinus virginianus aridus* from Tamaulipas).

BEATTY, HARRY A. New Bird Records and Some Notes for the Virgin Islands. *Jour. Agric. Univ. Puerto Rico,* **25,** 1941: 32–36.

BEHLE, WILLIAM H. Distribution and Variation of the Horned Larks (Otocoris alpestris) of Western North America. *Univ. Calif. Publ. Zool.,* **46,** No. 3; 205–316, 13 text figs. $1.25. (A scholarly, modern revision of the horned larks of the A. O. U. Checklist area west of the ranges of *hoyti, enthymia, leucolaema,* and *giraudi.* The author recognizes the forms listed in the 1931 Checklist and also *lamprochroma, utahensis,* and *sierrae*).

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